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THE

WEST OF ENGLAND JOURNAL

OF

SCIENCE AND LITERATURE.

Nos. I. II. III. IV. and V.

1835—6.

———"Quæ non fecimus ipsi
Vix ea nostra voco."
OVID.

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PREFACE.

THE Periodical of which the present number seems likely to prove the last, was established about a year ago by twenty-four of the inhabitants of Bristol and Clifton. By these gentlemen the present Editor was requested to undertake that office, and by them the expenses of the Journal have been supported, that is to say the expenses of printing and publishing, since none others have been incurred.

The general, and a very just cause of complaint against this Journal, has been the dryness of its articles; nor can this be wondered at when it be stated that, in the absence of other contributors, the greater part of the work has of necessity proceeded from one, and that an inexperienced pen; so that some of the papers are crude and ill arranged, and others written with a degree of obscurity, due rather to the want of complete knowledge of his subject on the part of the writer, than to any abstruseness inherent in the subject itself. In the multitude of clear and able living writers, it is hardly necessary to appeal to the works of Mrs. Somerville or Sir John Herschel, to prove abundantly that sciences of a far higher character than any here treated of, admit of being both adequately and popularly explained.

But however justly these censures may apply to the Editor's share in the work, they do not apply to the whole. There will be found in this volume a few contributions from those who have reached the summits of their respective branches of knowledge, and whose writings are therefore to be treated with attention and respect. Had not the dedication of an incomplete periodical appeared almost to be a burlesque, the names of Mr. Conybeare and Dr. Prichard would have been selected by the Editor, both on public and private grounds.

45, BRIDGE STREET, WESTMINSTER,
January, 1836.

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ADDRESS.

It has been intimated to the Editor, by those in whose opinions he is accustomed to confide, that upon the appearance of a work altogether of so new a character as the present, some preliminary Address is expected. Such an Address, if it states any thing, ought, it appears to him, to confine itself principally to three points—The causes which gave rise to the establishment of a Journal—The objects which, when established, it is intended to accomplish—And the manner in which its plan is to be carried into execution. These three points, then, he shall now attempt to develop more clearly and more at length, than the brevity and conciseness necessary to a Prospectus has hitherto permitted him to do: and in whatever is stated upon any of these points, or throughout the Address generally, the Editor wishes it distinctly to be understood, that he speaks not his own sentiments alone, but those collectively of the body of which he is the organ, and by whom the Journal has been placed under his immediate and unfettered superintendance.

Those who are conversant with the city of Bristol and its suburbs, are aware, that during the last few years the tastes and pursuits of a large section of the inhabitants have been undergoing a gradual but important change. Science and Literature have become more popular, the tone of general conversation has improved, and the demand for instructive and profitable books has proportionably increased.

The first indications of this change are to be sought for in the City Library, an ancient and respectable establishment, but which has undergone during the last few years a very marked improvement, both in the sum and the character of the volumes added to its stores. The number of its supporters has increased, the books are more generally read than they used to be, and their style is certainly higher. This collection, now containing many thousand volumes, is superior as a Library of reference to any similar provincial establishment in the

kingdom, and with reference to the great practical objects of circulation, is on the whole more liberally conducted.

A second indication of this change is to be found in the history of the Bristol Institution. Twenty years ago, when the plan of this Institution was first set on foot, the project was laughed at by many as chimerical; but since its establishment, a period of twelve years, it has been progressively increasing in importance. Its Reading Rooms are invariably much frequented; its Museum and six subordinate apartments were formerly ridiculed as absurdly large—they are now too small for the Collection, a large part of which remains necessarily packed up. The Collection itself is a large and respectable one, containing nearly complete Zoological, Conchological, and Mineralogical series; its unrivalled series of Crinoidea is by the monograph of the late able curator, Mr. Müller, too well known throughout Europe to need particular mention here. The collection of Egyptian Antiquities also is a respectable and an increasing one.

The manner in which the Theatre attached to the Institution has been occupied, is a strong proof of the justice of these remarks. In that Theatre there have been delivered annually, since the period of its opening in 1823, not fewer than from four to five courses of lectures, many of them by members of the Institution, for its benefit, and all attended by numerous and sometimes overflowing audiences.

Among the members of the Literary and Philosophical Society connected with the Institution, are many persons eminent in their respective spheres; and the papers read at the monthly meetings have been of a character often high, and always respectable.

Considering all these points, and taking into account the fact that these advances have been made during years of heavy commercial and domestic distress, in which Bristol has largely participated, we are surely warranted in assuming, that her inhabitants are not indifferent to either Science or Literature, and as a further consequence, that the present Journal, as it will encourage and direct those pursuits, will be in turn supported by them.

Nor are the prospects of such a Journal confined to Bristol. The neighbouring city of Bath possesses also her Institution, her Museum, and her Library; and boasts many inhabitants from whom, without at all wishing to interfere with the harvest of our neighbours, both scientific and literary communications may be expected.

But if we take a wider range, and include the extent of country of which our city is the Metropolis, we shall find still further corroboration of our views. To the Geologist, the Mineralogist, the Zoologist, and the Botanist; to the student of Natural History in any of its ramifications, our rocks and valleys afford ample material; and the man of practical art will find both occupation and instruction in the great manufacturing operations of the district, and in the business of a commercial port. At a greater distance, the county of Cornwall and the province of South Wales, offer objects of intense interest to the man of Science, the general Antiquary, and the Philologist. The iron works of Monmouth and Glamorgan are the largest in the world, and the mining operations in Cornwall, among the most extensive. The ancient language of both these districts—still preserved in all its purity in the Principality—its grammatical construction, and its general analogies to and connexions with other tongues, are well deserving attention; and every fastness is crowned by the traces of some British habitation, of some Roman encampment, or of some Norman fortress.

Such then are the causes out of which the prospects of our Journal originate; and such being the causes, the objects of the work are almost self-evident—the work should be the echo of the causes. It has been produced by the increasing local diffusion of a taste for science and literature; it will endeavour still further to promote that taste, by rendering more efficient and more available all the local facilities which our neighbourhood so amply presents for its cultivation. It will open a channel for the publication of the most valuable original communications, which may from time to time be made to the Philosophical Society attached to the Institution at Bristol. And—as many similar bodies are dispersed through the neighbouring counties—it is trusted that, should our Journal become permanently and respectably established, it would afford equal advantages to them, and thus become the centre of a system of union and co-operation, which must greatly increase the efficiency of Institutions of this description.

But while it will be one great object with us thus to give publicity to valuable materials of local origin, it will be equally our endeavour to supply brief but comprehensive announcements of all the most important works, whether British or Foreign, which may contain original discoveries, or throw material light upon any of the subjects which this Journal professes to include.

It can only be necessary to say a very few words on these subjects, under the

great divisions of Science and Literature. It has been our object in the present number, to introduce some of the principal of those subjects which appeared likely to display the widest field of interest, by preliminary dissertations, calculated to indicate our views of the actual state of those branches of Science, and the spirit in which it will be our wish to treat them.

With regard to Science, we shall endeavour to avail ourselves of all the peculiar local advantages afforded by the very interesting Geological situation of this Metropolis. Placed in the centre of a rich coal field, and yet on the edge of the great range of the oolites, and within a few miles of the cretaceous Downs of Wiltshire, on the one side, and the transition chains of the Quantocks and Exmoor on the other; we have, taking Bristol as a centre, within a circle of thirty miles, every Geological formation, from chalk to transition slate. Every walk through the lovely dales which diversify our scenery, is as rich in Geological interest as in picturesque beauty; and we may hope to open to our readers a new and copious source of instruction and pleasure in their daily excursions.

In Zoology it will be our object to enable our readers to consult with increased interest and instruction the ample collections already formed in our Museum; and by diffusing more generally a taste for such pursuits, to lead the way to that extension of those collections which may be well expected in a city whose inhabitants are commercially connected with every quarter of the globe, and where, therefore, the facilities afforded to the establishment of a superior Museum of Natural History must be proportionably great.

In the rapidly expanding and intimately connected sciences of Chemistry and the various branches of Electricity, we would fain hope to contribute to the forming a spirit among the members of our Philosophical Society, which might induce them to avail themselves of the advantages which the Laboratory and Apparatus belonging to our Institution are so well calculated to afford. The conveniences of private houses and private means, will scarcely ever afford opportunities for the successful cultivation of such pursuits; but it is one of the great advantages which Institutions like ours afford, that they fully supply this deficiency. Our apparatus already is ample; but it ought to be kept up to such a pitch, as to enable all our members (replacing of course any damage which might be occasioned,) to repeat every new experiment of which they read, and to prosecute original ones. This end will easily be attained, if a more general interest in such pursuits shall prevail among us. To excite that interest, therefore, will be our constant aim; and in proportion as we may succeed in directing

the intellect of Bristol more warmly to such subjects, we do not doubt that the city where, in his early life, Davy started as the assistant of Beddoes, will again yield an efficient supply of labourers in the advancement of science.

Every other branch of science will meet with due regard; but we have more particularly specified those only to which peculiar local advantages at present more especially direct our attention.

With regard to Literature, it will be rather our endeavour to seek for *critical* illustrations of *classical* Poetry, Philosophy, and History, than to overwhelm our readers with what are called "Original Essays;" well aware that in such compositions mediocrity is intolerable, and that it is very rarely permitted to the small literature of the provinces to attain that elevation which "Gods, men, and the columns," alone sanction as allowable. It will be by no means our ambition to open a foundling hospital for weak and unprovided offspring of this description. In scientific communications, provided the facts be important and accurately stated, the literary composition is comparatively of little consequence; but in essays of pure literature, indifference in this respect must be insufferable.

Our pages will ever be open to the interesting subject of Archæology; and we shall ever regard this subject in its widest extent, as including Ethnography, or the general history and antiquities of nations, their ancient mythological systems, and the like; topics obviously requiring a very different spirit of philosophical research from that which would restrict the pursuit to a mere "chronicle of old vessels or brass farthings." Actual Statistics, no less than Antiquarian researches, will demand our notice.

From this positive enumeration of the subjects we contemplate, it will be negatively evident that we do not propose at all to enter upon any ground, which can possibly introduce controversial subjects, whether of Politics or Theology. But in thus disclaiming *controversial* Theology, we shall ever be anxious that every line we pen may be found throughout marked by a general Christian spirit and Christian tendency.

It is not at all the intention of the promoters of this Journal to exercise any assumption, nor in any way to set themselves up in judgment over their fellow-citizens; they desire to promote the public welfare by the furtherance of those tastes and pursuits from which they have themselves reaped many advantages; and they have only joined together to do that more effectually which it is the duty of every man as a private individual to attempt.

In a work like the present, pecuniary gain is of course with all parties entirely out of the question; the only attempt has been to guard against heavy pecuniary loss. To those who do not agree in what has been written, and who by consequence disapprove of our Journal, we cannot of course look for support; but upon those who do approve of our plans, and who do think favourably of the manner in which they are being carried into execution, we have a strong and equitable claim; nor need we remind them, that at the outset of a periodical publication, and that upon new and untried ground, all support is doubly valuable. If such persons exert themselves and support the work, there is every reason to suppose that it will succeed and flourish; but if they do not support it, the funds upon which it at present rests becoming of course speedily dissipated, its career must be limited to a very few numbers.

Whatever the event shall be, whether the West of England Journal shall attain to a wide and flourishing circulation, or whether, after having lived through a few numbers, it shall cease and be forgotten, its promoters cannot of course say. But of this they can assure the public, that although they may not obtain, they will at least endeavour to deserve success; and that if they fail, they shall fail with the consciousness of never having pandared to the public mind, nor descended from the high and independent ground upon which they aspire to take their stand.

——— "Servetur ad imum
Qualis ab incepto processerit, et sibi constet."

Clifton, January, 1835.

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WEST OF ENGLAND JOURNAL

OF

SCIENCE AND LITERATURE.

No. I. JANUARY, 1835. Vol. I.

Art. I.—ESSAY INTRODUCTORY TO GEOLOGY,

BY THE REV. W. D. CONYBEARE.

In offering to the public the first number of a new provincial journal which professes to take as its principal object the endeavour to assist—as far as it may—in the general advancement of the various branches of scientific research, with an especial view to the development and more effectual application of the local resources and facilities afforded to the cultivation of those sciences by the various philosophical institutions, museums, &c. dispersed through the western district, which must constitute our peculiar sphere of influence; it has been held desirable to introduce our several subjects by short prefatory essays on their general nature, and on the peculiar local advantages to which we have adverted. To open with these views that department of our work which will be dedicated to Geology, will form the object of the following remarks.

It cannot be necessary to dwell at any length on the general importance and interest of this branch of physical enquiry—the strong hold, which, from its very infancy, this youngest of the sciences has exerted over the public mind, at once evinces the general conviction on these points; nor can this popularity be regarded as unsupported by the justest claims; for let us only cast a rapid glance at the principal subjects of investigation to which it invites our attention.

Like every other science of observation, Geology must in the first place be divided into its descriptive and theoretical portions; the former being the simple record of the phenomena observed, and the latter devoted to the examination of the inferences which these phenomena appear *necessarily* to suggest as to their causes.—We say "the inferences *necessarily* suggested," for no imputation can be more groundless than that which supposes that geological theories are mere fictions of the imagination gratuitously assumed *á priori*; they have ever, on the contrary, been based on strict

principles of deduction; and although the previous investigation may have occasionally been too hasty, and therefore the conclusion premature, yet this error is incidental to the infancy of every science, and necessarily corrects itself as the progress of observation extends. At present, whilst we should modestly acknowledge that much yet remains to be done before the structure of a perfect geological theory can be securely raised, yet we may confidently assert that very many of the most important elements of such a theory have been ascertained on evidence as incontrovertible as that which belongs to any other portion of our scientific knowledge.

To begin with the descriptive portion of Geology, the facts which it brings to our knowledge may be divided into three principal classes.

I. That the mineral masses constituting the crust of our planet are not, as might at first be ignorantly apprehended, confusedly huddled together in a chaotic mass, but originally disposed with great regularity, in distinct stratiform beds; and although the number of the individual strata be indeed so considerable as to seem to defy the powers of memory, yet we find these strata naturally associated together in certain definite assemblages, made up of reputed alternations of analagous beds, to which assemblages the term formations has been assigned; and as the number of these formations is itself limited, the task of committing a clear view of the series of rocks to memory becomes greatly facilitated, and may be still further aided by classing the formations under the more general head of groupes; and lastly, distributing the groupes under three principal orders—pursuing a system analagous to that by which we arrange the various species of animals—under genera, families, classes, and orders.—Such a tabular arrangement will be shortly submitted to the reader.

Now as it is ever delightful to discover order where only disorder was suspected to exist, this mental pleasure results in a high degree from this first step in our progress. Nor is it connected with mere intellectual gratification alone, but is moreover immediately subservient to purposes of the very highest statistical and œconomical importance, for these successive geological formations are very generally each distinguished by the abundance of peculiar metallic minerals, &c. which it contains. Some formations, for instance, being characterised by their richness in ores of tin and copper, others by lead and zinc, others again by iron, and by the principal deposits of that most essential of our commercial prosperity and domestic comfort, coal. It is the knowledge of the regular order of succession of the mineral formations, as developed by Geology, which alone can direct the practical miner in well-judged and profitable researches for these hidden but important elements of our national wealth, and guard against the disappointment, and often ruinous expense, which so frequently have attended on unsuccessful trials—the issue of which the Geologist would at once have predicted.

II. Besides these minerals of statistical importance, we find the succes-

sive formations also abounding in objects of the most interesting curiosity to the philosophical observer of nature, namely, various relics of the organized structures of vegetables and animals imbedded in the solid rocks; a large proportion of these remains are marine shells, and at once force home on the mind the obvious conclusion of the Roman poet:—

"Vidi factas ex æquore terras,
Et procul a pelago conchæ jacuere marinæ."

But our attention is not claimed by these organic remains solely on account of the striking fact of the occurrence in such situations, but still more by the very important circumstance that more than nine-tenths of them are of species altogether different from those which we at present find in existence, and in many cases even the very genera have vanished from the face of nature. The number of species of corals, echinodermata, and testaceous mollusca, known only in a fossil state, nearly rival in number the whole of the actually existing species;* the fossil fish are almost equally important. The class of reptiles presents us with many extinct monsters, some of which supply links which have subsequently dropped out and been lost from the great chain of nature, exhibiting in one instance (the Ichthyosaurus) a gradation from the ordinary structure of saurians to that of fishes; and in another (the Pterodactylus) a similar passage from saurians to birds. The fossil remains of mammalia, though confined to the most recent and superficial deposits, still present very generally extinct species, and in several instances extinct genera. Similar remarks will equally apply to the genera and species of vegetables preserved in a fossil state, which are in a majority of instances extinct.

Barely to mention these facts, must sufficiently evince that no person who is unacquainted with the vast supplements which Geology thus affords to Zoology and Botany, can be considered as adequately informed on those interesting departments of natural knowledge.

The different series of formations differ very materially in the species of organic remains which they include, and by which they are therefore said to be characterised. The species frequently vary from formation to formation, so that they have been said, almost without exaggeration, to be as regularly disposed in the geological formations, as in the drawers of a well arranged museum; hence if the fossils of any given locality be known, we may securely pronounce as to its geological formation, and vice versâ. But although the species be generally distinct in distinct formations, yet whole groups and orders of formations are related together by strong generic resemblances as to their organic remains.

* The splendid folio work of Goldfuss, now in the course of publication, and which promises to form the most complete illustration of organic remains ever given to the world, has devoted nearly 100 large plates, each containing more than 10 figures, to corals, echinodermata, and only two to genera of bivalves ostrea and pecten:— hence some idea of the number of fossil species may be formed.

To express these shortly—the lowest, and, as they are called, primitive formations, (granite, gneiss, micaceous, and other primitive slates, primitive marble, &c.) are well known to be destitute of organic remains, which first appear in the next, or transition class, (consisting of coarse roofing slates and various sandstones, called by the Germans grauwacke, together with interposed beds of limestone). With these it is clear that the carboniferous series of rocks must, from the close generic relation of their organic remains, both animal and vegetable, be associated as the upper group of the same order. The anthracite, or culm alternating with the roofing slates of North Devon, is in fact a true grauwacke coal formation, and closely agrees in the relics of vegetables which it exhibits, with the great coal formation. The remains of this most ancient groupe, which thus exhibits the first traces of animal life, are very numerous species of corals and madrepores; specifically distinct, but not perhaps generically so, widely separated from the existing types of this class, as is the case with most of the other divisions of the animal kingdom here imbedded.

Of the echinodermata, the crinoidea present six genera, including eighteen species; all of these belong to the division inarticulata, characterised by having the part enveloping the viscera inclosed by thin testaceous plates, something like the shell of the echinus, while all the species in the rocks younger than this lowest order, agree with the only species of this once very numerous class still known to exist, in having the lateral portions of the frame work, containing the soft parts, formed into more thick and regularly articulated ossicula. Here we see the geological and natural subdivisions of this interesting animal class mutually illustrating each other. This family of echinodermata was first fully described, and all the complicated details of its anatomy minutely explained, by the sagacity and admirable industry of Mr. Miller, the late Curator of the Bristol Philosophical Institution, in his unrivalled monograph of the crinoidea. His extensive collections for this purpose form a most valuable portion of the museum there established.

Of the bivalve mollusca nine-tenths belong to the single family of brachiopoda, which is distinguished by having a pair of ciliated spiral arms, one on each side the mouth, and forming an attachment to the bodies, on which it rests by a pedicle issuing from a perforation over the hinge of the convex valve. In the fossil genera the adaptation of the shells to their class of mollusca is clearly seen, and in one instance spiral calcareous loops are preserved in the interior of the fossil shell, (hence called spirifera), which appear to have formed a support to the arms, like the elastic calcareous loop in the recent terebratula. The fossil genera of the transition series are however widely different for the most part from the recent, and often assume what to eyes acquainted with recent Conchology must appear very grotesque forms. There are several of these extinct genera, some confined to the lowest, others common to the lias, and other more recent

formations. The genus terebratula also, which pervades all the geological formations and still continues to exist, has a few but more rare representations, even in this early period.

Of bivalves less widely distinguished from recent types, a few cardia, and perhaps oysters and pectens, are said to have been found, but these are comparatively rare.

Of the gasteropodous univalves we have a few very peculiar forms, apparently congenerous with the pectinibranchia trochoidea. Some of the buccinoidea are enumerated in lists, but these are certainly very rare.

Of the concamerated shells, which contain cephalopodous inhabitants, (a race to which the cuttle fish belongs, though destitute of a shell, in place of which the mantle has only secreted the well known lamelliform calcareous bone,) the lowest fossiliferous beds present several species of the straight family, the orthoceratites, which has entirely ceased to exist, and is represented under a very different form by the belemnites of the secondary rocks. Of the spiral families, the ammonite, which continues through the secondary formation, but had become extinct before the tertiary, and the nautilus, which pervades the whole geological series, had already appeared, but the species are distinct and the specimens rare.

Still ascending in the animal kingdom, we find among the marine crustacea a remarkable family, the trilobite, or Dudley fossil, of which the lowest fossiliferous beds afford three genera, although the whole family appears to have become extinct before the period of the secondary formations.

With regard to the fossil vertebrated fish, their history is only at the present moment beginning to be understood, through the labours of M. Agassiz, of which only two livraisons have yet appeared. His remarks, however, on this branch of our subject, are strongly confirmatory of those which have been already suggested by other departments of the animal kingdom. In his perfectly original method, he divides fish into four orders.

1. Placoidians, including Cuvier's cartilagineæ, with the exception of the sturgeon.

2. Gonoidians, fifty extinct genera, only plectognathus, syngnathus, and acipenser recent.

3. Ctenoidians, including acanthopterygians, minus those with smooth scales, and plus the plearonestes.

4. Cycloidians, the malacopterygians, minus the pleuronectes, and plus the species banished from the last order.

The two latter orders are prevalent in the existing state of things, comprehending more than three-fourths of the fishes which now live; but in the geological series, these orders are confined to the superior formations, viz. the chalk and tertiaries; and in all the lower formations, the two first orders which now constitute merely a small minority, not only become the majority, but prevail altogether exclusively.

In the lowest fossiliferous order of formations, of which we are now treating, many peculiar genera exist. An entire distinct family of gonoidians is here found, having their vertebral column prolonged at its posterior extremity into a single lobe, which reaches to the caudal. Here also we find fishes more approximating to the type of saurian animals in the bones of their skull and powerful conical teeth; the remains of true saurians do not, however, appear to be yet found. The teeth from the carboniferous limestone of Burdie house, near Edinburgh, being pronounced by M. Agassiz to belong to these sauroid fish.*

We also here find those great pointed rays, called ichthyodorulites, heretofore confounded with the rays of the balistes, but now ascertained by M. Agassiz to have belonged to shark-like fish of the placoidian order; these occur in the very lowest of the fossiliferous beds, but, though with difference of specific character, recur throughout the geological series to the chalk inclusive.

The vegetation of this period appears, from its fossil remains, to have consisted in a very great proportion of vascular cryptogamiæ, among which are large tree ferns, allied to those which still exist in tropical climates, and the fossil lepidodendra appear to be allied to the lycopodiaceæ. A few monocotyledoneæ, viz. palms and arborescent iliaceæ also occur; and in some of our coal formations, Mr. Witham has also established the existence of coniferæ. The whole character of the vegetation is such as we should expect to find prevailing in a very high temperature and moist atmosphere, under circumstances, in short, analogous to those which characterise tropical islands.

I have been more minute in my statements concerning the organic remains of this lowest fossiliferous series, (although I have still confined myself rather to general facts than particular details) because the foundation being here clearly laid, the elucidation of the organic remains or palæontology, as it has been termed, of the more recent formations will only require a brief notice.

The consideration of the animal remains of these earliest deposits, exhibiting the very first traces of animal life, derives moreover additional physiological importance from the complete refutation it appears to furnish to the extravagant hypothesis of some French naturalists, such as Lamarck and Geoffroy St. Hilaire, concerning the progressive development of the animal kingdom, by the gradual conversion of inferior into the contiguous superior species. It should appear that they consider creative power as incompetent to have produced more perfect forms until he had first tried

* A saurian vertebra, however, is said to have been found by Mr. Vernon in the carboniferous limestone of Yorkshire; can this also here belong to the sauroid fish of M. Agassiz? He says that these vertebræ do not resemble the saurian type in the articulation of the spinous process to the body.

" his 'prentice hand " in various preliminary experiments on simpler structures.

But how little countenance all this will derive from geological research, must be obvious from the slightest consideration of the foregoing catalogue: that list is indeed confined to marine animals. Though vegetable remains, which must have been derived from considerable terrestrial forests, prove that dry continents must already have reared their heads above the waves; and it may seem little agreeable to the analogy of all that we can observe of the regulations of providence to suppose, that these continents should have been left untenanted by appropriate animals, yet this subject must always remain mysterious; and although we should incline to suppose that such terrestrial animals may then have existed, it will not be very difficult to account for the non-discovery of their remains in tracts which must then have been only part and parcel of the " dark unfathomed depths of ocean." But although thus confined to marine genera, we can find no trace of less perfection of organic structure in those races than in their actual successors in similar situations: if we consider separately each order of animals, we do not find the simplest forms of that order in the oldest rocks, and these progressively growing more complicated and perfect in the succeeding geological periods; quite the reverse, we have from the very first the crinoidea, by far the most complicated forms of the echinodermata; the cephalopoda, which are at the head of the mollusca; and vertebrated fish, which appear to have been quite as perfect as their congeners, the sharks of the present day. The forms are different indeed, but it does not appear that they are inferior; and if we consider the immense step there is between the simplest forms of animal life, and a structure like that of any of the vertebrata, a shark for instance, such as occurs in these fossiliferous beds, it must be obvious that the interval between the latter and the most perfect of the mammalia is comparatively so very trifling as to be quite incommensurable.

To proceed to the next, or secondary order of fossiliferous beds, including, 1. The pœcilitic groupe, so called from the variegated, or new red sandstone, which is intimately associated with the magnesian limestone, or zechstein, as its lowest member; and, in its upper part, with the muschelkalk of the continent, (a formation which does not occur in this island.) 2. The three divisions of oolites, reposing each on a thick argillaceous deposit, of which the lowest is the lias; these oolites are separated from the next groupe in the weald of Kent by a large formation of fresh water, sand, and limestone; but this has not yet been noticed elsewhere. 3. The cretaceous groupe, consisting of chalk reposing on green sand; the latter being subdivided into upper and lower.

The fossils throughout this groupe bear strong generic resemblances, although, as might be naturally expected, the extreme terms, viz. the magnesian limestone below, and the chalk above, exhibit a gradual ap-

proximation to the characters of the inferior fossiliferous beds on the one hand, and to the superior tertiaries on the other.

In these beds we have equally various aggregations of madreporal corals, and although many of the older forms of the lower groupe have disappeared in the echinodermata, several varieties of echinus occur abundantly. Some species of asterias and comatula also appear; and a new division of crinoidea, the articulata commences. It exhibits several genera and species, most of which are confined to this geological groupe; but one of the genera, the pentacrinite, still exists; and indeed the very recent species differs but slightly from that of the lias. Among bivalves, the brachiopodal class presents a large variety of species of terebratula, some of the older forms of the lower groupe, e. g. the productæ, still mark the magnesian limestone, and the spiriferæ extend as far as the lias. Of the other bivalves, the genera are as numerous as those of the present day, with which they nearly agree;* but the species are always distinct. To the univalves the same remark will partly apply, but we must modify it by observing, that the genera of the division buccinoidea are few and rare in the lower and secondary beds, but suddenly develope themselves in great numbers in the subcretaceous sands, which in this respect present an approximation to the tertiary character or superincumbent group.

The cephalopoda exhibit in this groupe the family of belemnites, which is peculiar to it and universal throughout; of its members, the ammonites are also very abundant and characteristic, for though they have already appeared in the lower group, still they are there rare, and they do not extend into the tertiary group. There are also some very remarkable genera, or rather families of this order, peculiar to the cretaceous group, not being found either above or below it; some of these, the turrilites, are distinguished by the convolution of the chambered tube into the heliciform spiral, like a corkscrew; in others this tube is only slighly curved at the extremity, like a hook-hamites and lituites; in others it is curved at both extremities, scaphites.

Marine crustacea occur in the secondary group; and here they no longer exhibit those forms so remote from the actual types as in the trilobites of the lower group, the existing genera astacus and paguras, (cray fish and hermit crab,) are sufficiently marked, though the species probably differ; they are found in the lias, in the lithographic calcareous slate of Solenhofen (belonging to the upper oolites) and in the chalk.

Of the vertebrated fish, we find only the two earliest orders, (if we may

* We should observe that the genus gryphæa, which is exceedingly abundant throughout this period, having twenty species, has only one recent, and even this is very doubtful; neither does it occur fossil above the chalk. Exactly the same remark will apply to the genus trigoniæ, of which twenty-one fossil and only one recent species is known, and which is likewise wanting from the tertiary order of geological formations.

so speak) the placoidians and gonoidians in the beds beneath the chalk; and of these fossil remains, not only the species, but all the genera likewise are now extinct, the orders alone remaining. Many species of the shark-like placoidian, with ichthyodorulites, are found in the various formations of this groupe; but the species contained in different formations, are in every case distinct; this is indeed a general law with regard to the distribution of fossil fishes. The gonoidians are characterised by possessing a symmetrical caudal fin.

The chalk, with regard to its fish, approximates more to the character of the superincumbent tertiary groupe, it presenting for the first time genera of the more recent orders of ctenoidians and cycloidians; but still the genera occurring are for the most part, though not universally, extinct.

The saurian reptiles now make their first decided appearance, and seem to have been most abundant; and in the variety of their genera and species, to have greatly outnumbered the present state of this class. In the continental equivalent of our magnesian limestone, monitors appear; and at Bristol remains have been recently found, intermediate between the crocodile and megalosaurus. In the lias we have those vast marine monsters, the ichthyosauri and the long necked plesiosauri, mingled with a species of gavial, widely distinguished from the recent. Either species of all these genera occur in the superincumbent oolites, together with the mososaurus and the megalosaurus; and in the sandy limestone of the weald, a singular saurian, armed with a horn, and possessing the teeth of the iguana, is likewise found. And to these saurian reptiles, we may add the remains of a species of turtle.

Of terrestrial mammalia, one single specimen, the jaw of an opossum, has been found in the slaty oolite of Stonesfield, near Oxford; but this sufficiently attests the existence of these higher animals during this geological period, and clearly proves that we must not infer that such species had not been created, because we do not find these remains where in truth we can hardly expect to find them, in these deposits of an ancient ocean. It may perhaps hereafter be found that certain portions of these deposits have, more than others, the characters of literal deposits; and in these we should be most likely to recognize the remains of terrestrial animals.

Although the low organization of insects would have required us, in a strict method, to speak of them much earlier, yet as terrestrial animals we may here notice, that in the same Stonesfield quarries last mentioned, the elytra of coleopterous insects are found; and that very perfect species of libellulæ occur in the lithographic calcareous slate of Solenhofen.

As to vegetation, this order is said to require a subdivision into two stages; the lower including the pœcilitic groupe, and the upper the oolitic, and cretaceous. The pœcilitic vegetation includes about twenty species, differing alike from those of more ancient and more modern formations. The cryptogamiæ are less numerous, and of smaller size than in the more

ancient order. A few very singular species of monocotyledoneæ, and a peculiar genus of coniferæ appear, but as yet we find no cycadeæ.

In the next period, including the oolites and cretacea, the cycadeæ make their appearance, and become very prevalent; these, together with the coniferæ, which may be associated into a particular class, constitute, not as at present, $\frac{1}{300}$ of the vegetable species, but more than one half of this upper secondary flora. The remainder of this flora consists principally, as before, of vascular cryptogamiæ, but of new species. The monocotyledoneæ are still rare, and there are no signs of the existence of dicotyledoneæ, which constitute four-fifths of the actual vegetation.*

We have lastly to proceed to the examination of the fossil Fauna and Flora, of the most recent or tertiary order of formations; and here we shall perceive, in every instance, a gradually increasing approximation to the existing forms of nature; this approximation becoming just apparent in the lowest groupe of tertiaries, partial in the middle groupe, and complete in the upper; whence they have been denominated by the author, who has thrown the clearest light on the subject, 1. Eocene, (the dawn of a recent state); 2. Meiocene, (the less recent); and 3. Pleiocene, (the more recent). It has been ascertained that these groupes contain respectively the increasing proportions of three, nineteen, and fifty-two per cent. of fossil species of testacea,† identical with those which still actually exist. The great abundance of buccinoidian univalves is peculiarly characteristic of these groupes. The same remarks will apply to the encreasing number and approximation to recent types of the marine crustacea. The older saurians have disappeared, and are replaced by a species of crocodile, which first exhibits in the articulation of its vertebræ, a type exactly agreeing with the recent species. Several species of turtles likewise occur. The fish of the tertiary formations approach nearest to recent fish, yet hitherto only a single species exactly identical, has been discovered. In the inferior tertiary formations, a third at least of the species belong to genera which exist no longer. The species of the superior tertiary formations are related, for the most part, to genera now common in the tropical seas. As many of the deposits appear to have been not marine, but from fresh-water lakes,‡ we have also lacustrine species of testacea, &c. and the proximity of dry continents being thus indicated, we may naturally expect to find, as

* In the inferior oolite, of Yorkshire, equisetaceæ prevail. The abundance of vegetable matter is here sufficient to yield regular carbonaceous strata.

† Corals are perhaps less generally prevalent in the tertiary than in the secondary deposits, yet the middle tertiaries in Lower Styria afford great abundance, composing a coralline limestone, which much resembles the coral rag of our middle oolites, both very accurately representing the coral reefs which prevail in tropical seas.

‡ In many instances we may observe alternating series of lacustrine and marine deposits, as if the same tract had, from some oscillation of the level of its surface relatively to the level of the sea, been exposed to repeated submersions and alternate emersions; but this is not the place to enter into theoretical discussions.

we do find, a greater variety of terrestrial species than heretofore. Insects of all the recent genera, and many species nearly approximating to those still existing, have been discovered.

The mammiferous remains imbedded in the three tertiary groupes, observe the same progression which we have already noticed in the testacea, extinct palæotheria, &c. alone occurring in the lowest groupe; while the middle groupe exhibits these, with a mixture of the elephants, &c. of our own diluvial gravel; and the latter class become prevalent in the superior groupe.

Lastly, the vegetation of this superior geological order approximates in the same degree to that actually existing: it presents the same classes, and in similar proportions, the dicotyledoneæ being the more numerous, then the monocotyledoneæ, the gymnospermous phanerogameæ, and the cryptogamiæ and agamiæ taking the last place. The general character of this vegetation is that which might be expected to prevail in extended continents, of which the temperature was perhaps somewhat more elevated than at present; but considerable local differences may be observed in this respect, such as would naturally arise from varying local causes of unequal temperature, such as difference of elevation, &c.

These remains often give rise to considerable carbonaceous strata, in which the woody fibre is still to be distinctly recognised as lignite. In some places the middle tertiaries assume characters which might, at first sight, almost be confounded with those of the older coal fields.

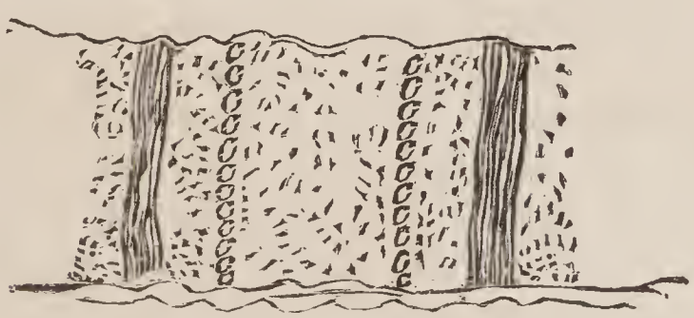
In concluding this rapid survey of the geological distribution of organic remains, we cannot fail to observe, that they very generally indicate the ancient prevalence of a much higher temperature than that which at present belongs to our temperate climates. We have almost always animal and vegetable forms, which belong to the warmest latitudes; the coral reefs of tropical seas; with pentacrinites, like those now found on the coasts of Barbadoes; the testacea, fish, crocodiles, and turtles, of the same torrid oceans; and in the land, forests of palms and arborescent ferns. And though this is less markedly the case in the Flora of the tertiary period, yet still we find the fish of tropical seas sporting around the coasts; the hippopotamus, stalking through the rivers; elephants, rhinoceros, and hyænas, roaming through the jungles.

We may conclude these two articles of descriptive geology, namely the order of geological formations and the organic remains which they present, by a synoptical table, calculated to assist the memory.

ORDERS.	GROUPES.	FORMATIONS.
III. Tertiary order, containing organic remains of zoophytes, testacea, insects, and mammalia, approximating to the actually existing species.	Pleiocene $\frac{5}{100}\frac{2}{0}$ recent species.	The Formations constituting these groupes have too many local variations to admit of synoptical arrangement.
	Meiocene $\frac{1}{100}\frac{9}{0}$ recent species.	
	Eocene $\frac{3}{100}$ recent species.	
II. Secondary order, containing marine remains, differing entirely in species, but approximating in genera to those actually existing, the genera also often extinct; terrestrial animals very rarely discovered; saurians very abundant. Cycadeæ prevail among the vegetables.	Cretaceous groupe.	Chalk.
		Upper green sand.
		Lower green sand.
		The lacustrine sands and limestone of the Weald are occasionally interposed.
	Oolitic groupe.	Upper Portland oolite, reposing on Kimmeridge clay.
		Middle oolite, or coral rag, reposing on Oxford clay.
		Lower, or Bath oolite, reposing on lias.
	Pœcilitic groupe.	Muschelkalk, or conchite.
		Variegated sand and marl, with salt and gypsum, or pœcilite.
		Zechstein magnesian limestone, or dolomite.
I. Inferior order, or transition and primitive; the upper groupes contain marine zoophytes, testacea, and fish, of which the genera as well as species are mostly extinct, and differ very widely from the actual types. The lowest groupe is non fossiliferous.	Carboniferous groupe.	Coal measures.
		Mountain, or carboniferous limestone.
		Old red sand stone.
	Grauwacke, or Clasmoschistose groupe First appearance of organic remains.	Upper grauwacke, with Dudley limestone, abundant in fossils.
		Middle grauwacke.
		Lower grauwacke, or roofing slate of Cornwall and Snowdon, with few fossils.
	Micaschistose groupe; non fossiliferous.	Micaceous and other nonfossiliferous slates and primitive marble.
		Gneiss.
		Granite.

The third head of descriptive Geology of which we have to treat, will relate to the nature of the dislocations and disruptions which appear to have affected the strata. To investigate the causes, indeed, of those dislocations, may appear rather the business of theoretical Geology; but simply to describe them, is obviously the mere record of observation.

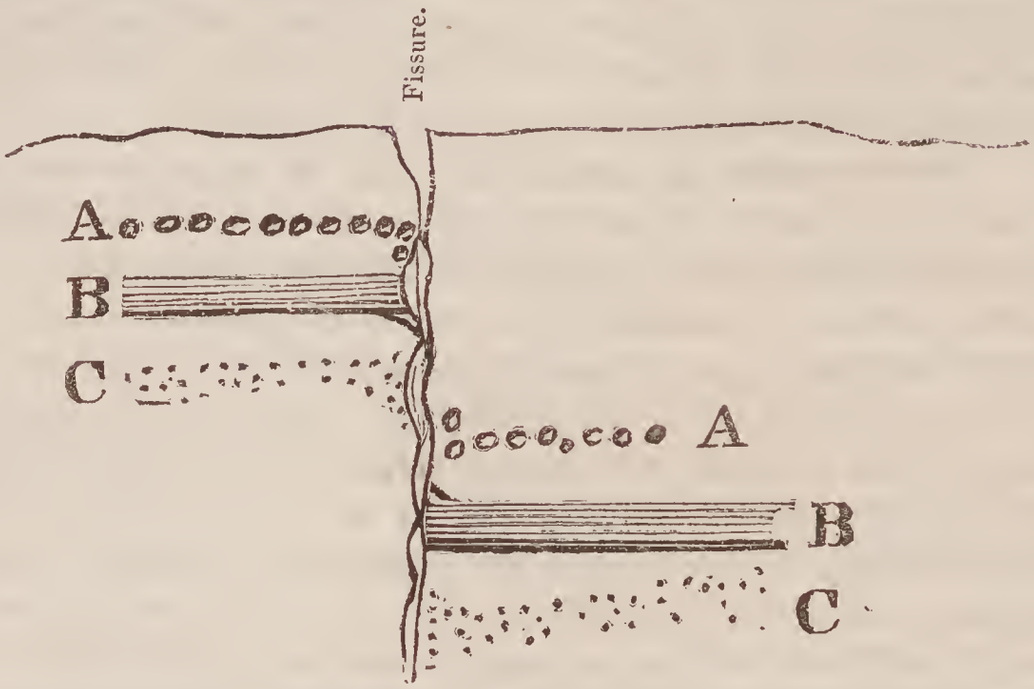
§ 1. Now to render our statements clear, we must premise the remark, that it is clearly evinced from the manner in which the shells, &c. are imbedded in these strata, that they were originally deposited in a semifluid state; and as the materials of the matrix are generally found to have penetrated into the minutest pores of those shells, its original state must have been that of even more than semifluidity. Now it is self-evident, that such deposits can originally have been precipitated only in flat horizontally disposed masses; but we actually observe the strata to be very seldom strictly horizontal, and very frequently, especially in the rocks of the inferior order, to have their planes inclined in very considerable angles, from 45° to 70° with the horizon, becoming sometimes quite vertical. The case becomes still more striking, when we find there stripes of conglomerate rocks, which must have originally consisted of loose gravel, thus vertically disposed. In the tertiary formation of Alum Bay, in the Isle of Wight, we find beds still consisting of uncemented sand, with bands of loose pebbles in this position :—



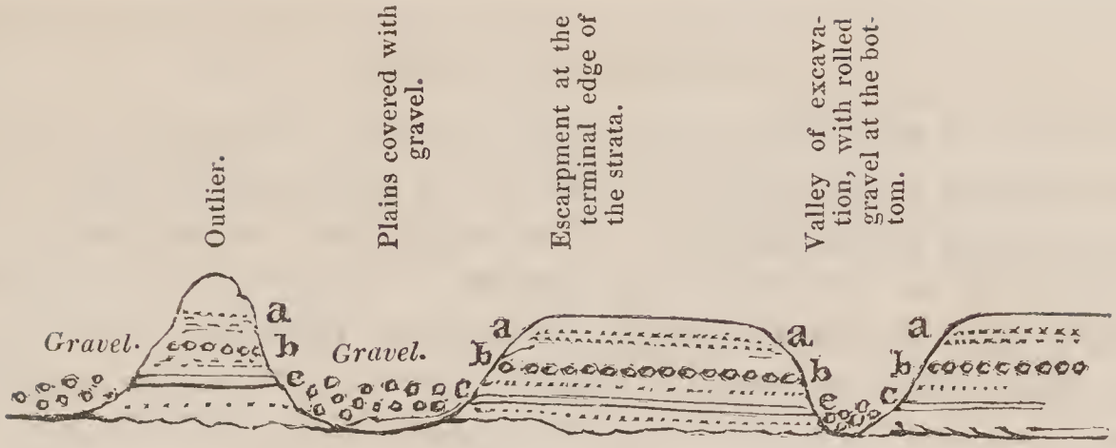
Now the simplest laws of gravity prove, that these materials could by no possibility have been accumulated originally in their present position, or in any other than horizontal planes; their actual situation must therefore necessarily be attributed to some species of dislocation.

§ 2. Again, the necessary mechanical laws of their deposition must evince, that any given series of deposits must originally have been arranged in continuous planes. But we actually often observe such a series, after proceeding continuously for a considerable distance, interrupted by a vertical cleft or fissure cutting across the rocks; and we find the same series repeated on the other side of that fissure, not in the prolongation of the same planes, but with an alteration of level sometimes of only a few inches, sometimes of one hundred fathom. It appears self-evident that we must attribute such an arrangement to dislocation, attended with the sinking of the whole rocky mass on one side of the fissure; or (which will affect the same relative change of level) the elevation of the portion on the other side. Such cases are called faults, a term introduced by miners, who having pursued a bed of coal to such a fissure, became at a fault how to find its place on the other side. They are not, however, left without a guide, for the extremities of the strata where broken off, are generally

found to be bent upwards or downwards, thus indicating in which direction their prolongations are to be sought.



§ 3. Besides these dislocations, we often find the continuity of series of horizontal strata interrupted by valleys, which, as it were, effect breaches in them, having the same series, layer for layer, repeated on the opposite sides of the valley. In such cases we often find the base or outlet of the valley overspread with broken fragments of the strata, which we conceive must have originally extended continuously across it. Now to put an analogous case; if we were to observe an abrupt interruption in a regular wall, built in orderly courses of masonry, and were to find this breach loaded by shattered fragments of the materials which were deficient in their regular place; could we then hesitate to attribute the said breach to violence, which had affected the wall subsequently to its original erection? And will not the same reasoning apply with equal force to the valley in question? The rocky fragments which are spread over its base, are generally found to be rounded into boulders and pebbles, exactly like those which are worn by the action of water. Now if we were to attribute the excavation of these valleys to the action of violent currents of water, we might seem to be running into theory; but it is scarcely possible to describe the phenomena without employing language which must naturally suggest such a conclusion. These valleys are called valleys of excavation; they traverse the horizontal strata exactly in the same manner that the graver of the artist, in cutting an intaglio on a stratified onyx, penetrates its various layers. The terminal edges of the masses of our strata, appear to have been very generally abraded by the same action which has excavated these vallies, and thus are made to end with steep declivities or escarpments, as they are called. The plains at the foot of the escarpment, are extensively overspread with rounded fragments of the abraded rocks; and this gravel generally contains remains of the elephant, hippopotamus, rhinoceros, hyæna, &c.



Sometimes detached masses of a given series of strata will constitute insulated hills, now separated from the main range of the said strata, which must, however, originally have spread over the interval whence they are now removed. These phenomena seem to attest the very destructive forces which must have acted on the face of our planet.

§ 4. The phenomena of active volcanoes are well known, and need not here be repeated. But, besides the volcanos still active; central France, the banks of the Rhine above Bonn, and many other places, present regular craters, torrents of lava, and whole districts covered with volcanic ashes; so as to leave no doubt that the same igneous action has here also originally prevailed, though the fires be now extinct. But besides these undoubted volcanos, we also find irregularly breaking into and traversing the regular strata, and filling up vertical fissures with masses, which are called dykes. If we examine the substance of these unstratified and interfering rocks, (which are called trap-rocks,) we shall find it closely agreeing in mineral composition with the undoubted volcanic rocks. If we look at the effect which such trap-dykes produce on the strata which they intersect, we shall find such as would have resulted from the contact of masses of heated lava indurating the soft strata, charring the coal beds, &c.* Be it observed, that we do not now theoretically assert that fire has been the agent producing these effects; we simply *describe* the phenomena when we say that they are such as would have resulted from igneous agency. Among the primitive rocks, granite performs a part quite analogous to that which trap performs among the secondary; and some varieties of granitic rocks insensibly graduate into some varieties of trap. All the phenomena indicate a close relation of analogy between these formations.

* When trap-dykes indeed, intersect limestone, they do not turn it to lime; but on the contrary, convert it into crystalline saccharine marble, as may be well seen where the trap-dykes cut the chalk, in the north of Ireland. But it has been found by experiment, by Sir James Hall, that this is exactly the effect produced by heating limestone, under the pressure of a column of water. I have seen the specimens he produced by thus heating lime, at the bottom of a tube of gun barrels, filled with water, and placed vertically, and they exactly resemble the altered Irish chalk, at its contact with the trap-dykes. The effect here produced, therefore, is such as would have resulted from the intrusion of igneous masses, ejected beneath the pressure of an incumbent ocean, by a sub-marine eruption.

THEORETICAL GEOLOGY.

Thus far we have abstained from all theoretical inferences, which the most sceptical could tax with any shadow of gratuitous assumption, and dealt simply in pure description. The error, if error there has been, must therefore, up to this point, have consisted in positive false statement: there has been no possible opening for delusive reasoning. Yet whoever has weighed this description, if he barely allows it to have been accurately given, must surely be struck at the overwhelming mass of novel and astonishing facts which this science, in its very elemental observations, places before his view; and he must feel that many of these facts necessarily carry with them the most direct evidence of those theoretical inferences, which before perhaps he ignorantly considered as the arbitrary fictions of visionary dreamers, scheming how they might construct after their own imaginations. These inferences he must now perceive are, to a very great degree, the necessary conclusions of the soberest interpretation of nature,—never assumed â priori, but carefully deduced â posteriori.

In the first place, he will at once perceive that nine-tenths of the existing continents have originally been buried many fathoms beneath the bosom of the primæval ocean. He must therefore of necessity seek to account in some manner for this great change of level between the land and water. And here only two possible classes of hypotheses present themselves, of which one or the other alternative must be true:—either the water has in great measure disappeared, through chemical decomposition, by becoming fixed in some of the deposited minerals, and the like; or else a relative change of level must have been mechanically effected, by forces tending to elevate the masses of the continents, or depress the receptacles of the oceans. Now of the chemical hypothesis he will find no evidence, and it must rest entirely on gratuitous assumptions. With regard to the mechanical hypothesis, he will argue, if this be true, the strata must necessarily have undergone great disruptions and dislocations. He will proceed to examine them with this view, and on his examination, he will find that they do actually present the very phenomena he had anticipated as necessary conditions of the mechanical hypothesis.—Vide Supra III., Sec. 1 and 2.

Allowing, then, the probable conclusion in favour of the mechanical elevation of the continents, he may further desire to enquire whether this operation has gone on uniformly, or been attended by oscillations. In answer to this enquiry, he will again proceed, not by gratuitous assumption, but by carefully interrogating facts, and examining the phenomena. The present writer believes the answer he will obtain will be in favour of considerable oscillation. His induction may be imperfect; but assuredly his conclusion is not gratuitous. Again, the enquirer may reasonably demand what would be the probable effects of this process of elevating the

continents, which from the phenomena of dislocation, appears in a great degree to have been accomplished by very violent convulsions. He will naturally conclude, that thus violently raising such vast masses from the bosom of the ocean, must have necessarily produced distinct waves and currents, which would have swept over the emerging surface with the most destructive efficacy; and he will find the actual phenomena again in harmony with his anticipations. Vide suprâ III. 3.

Should he wish to enquire into the probable forces which may have operated in thus elevating such vast portions of the crust of our planet, the only similar force which the analogy of nature presents to him, will be that which in the classical ages elevated the Grecian promontory of Methone, and in more recent times has raised the Mexican Jorullo and the Italian Monte Nuovo, and created new islands among the Azores and in the Mediterranean,—the force of earthquakes and volcanos, a force still producing effects exactly similar in kind, though very inferior in degree. It was exactly thus that a very able writer of Greece, Strabo, originally reasoned; and the more observation has proceeded, the more his conclusions have been confirmed. In examining geological phenomena, with reference to this question, he will notice as corroboratory facts, the far more extensive prevalence of volcanic action in the earlier geological periods; and the strong analogies which favour the presumption, that the very fundamental rock on which the whole rests (granite), was itself originally in a state of igneous fusion. This may perhaps lead him still further to incline towards the belief of Leibnitz, that the nucleus of the earth was originally brought into a state of fluidity (and that it must have been fluid, its figure physically demonstrates), by igneous action: and that its present solid crust has originated partly from the refrigeration of the surface of this mass, and partly from the precipitates from the circumambient ocean. This view of the subject is well illustrated, in some of the diagrams in the concluding volume of Lyell's very able elements; but he will perhaps draw a further inference from these very representations, which that author has failed to draw; for he may see in them an evident reason why the perturbations of this igneous mass, acting in the earlier periods, when the crust which confined it was as yet in a thin and almost nascent state, and could therefore have opposed but a comparatively trifling resistance, must have produced effects incalculably superior in degree to those for which they are at present adequate, when repressed by the enormous column of resistance which the whole thickness of the actually consolidated crust at present offers. If we believe, as Mr. Lyell is most anxious that we should believe, that the laws of nature are ever permanent and uniform, we must admit it as one of the plainest of those constant laws, "*that the same given force, when it acts under a less resistance, must necessarily produce far more powerful effects than when it acts under an increased resistance.*" And if I may be allowed this axiom, I hold myself able to prove, from

Mr. Lyell's own diagram, as clearly as any mathematical truth may be demonstrated from the diagrams of Euclid, the proposition which nevertheless he somewhat unaccountably supposes himself to be opposed to, namely, that the actual convulsions of the crust of our planet neither are, nor, on the evidence which he has himself adduced, can possibly be, equal in intensity to those which prevailed in the earlier geological epochs. Instead, therefore, of comforting ourselves, as he does, with the prospect that we may expect in our own days convulsions violent as those which upheaved Mont Blanc, or "Chimborazo, giant of the western shore," we may rather repose with Leibnitz, (assuredly not a less philosophical authority,) in the persuasion, "Tandem quiescentibus causis atque æquilibratis, consistentior emergeret rerum status."

And here, purporting to proceed in my next communication to the local facilities which the neighbourhood of Bristol presents to the study of Geology, I should conclude, were I not anxious to remove from the mind of the reader every feeling which may possibly arise in his mind, of any supposed hostility of those convulsions of human science, to the dicta of a wisdom whose influence is as far more valuable to the best interests of man, as its origin is from a higher source. I would particularly invite the attention of such to the discussion on this subject which has already appeared in that most excellent journal, the Christian Observer, (Nos. for May, June, July, 1834,) whence I may quote the following observations.

"Several modes have been proposed of conciliating with the sacred record the conclusions forced upon the mind by the facts of Geology. They are chiefly the following:—

1. At an earlier period of the science, De Luc and others imagined these beds to have been accumulated beneath the bed of the *antediluvian* ocean, between the six days of creation and the Noachian deluge; and that at the latter epoch, by a sort of general oscillation of the surface, the oceans and continents changed place. This view has been now generally abandoned, partly because the time, 1600 years, seems insufficient to account for the phenomena; an objection of great weight, though we should hesitate to assert that the point admits of absolute demonstration. A greater difficulty is, that in this case we should hardly expect to find so many successive veins of different organic genera; the latest rocks alone containing any approximation to the present *orders*, and alone also containing any traces of terrestrial animals. All the phenomena seem to suggest *successive periods of animal creation, closing* with that of the *land* quadrupeds, and *antecedent* to the existence of *man*. The difficulties in the way of this interpretation would therefore be very embarrassing, though we cannot affirm that they are insuperable.

2. The next solution is by means of a *former creation*, interposed between 'the beginning' (Gen. 1.) and the six days, which had become extinct, and whose ruins formed the chaos of the second verse—referring the organic remains to this supposed *former* world. We have already alluded to this passage, as respects its exposition; but, in addition to the point of biblical criticism, there is a physical difficulty, arising from the idea that this former supposed world possessed light, and probably a sun, and a general system of animal and vegetable economy, analogous to the present. Those, therefore, who adopt it, with Dr. Chalmers, explain the words which more naturally seem to imply a *first* creation, as denoting a *re*-creation of objects previ-

ously existing, but then extinct. They must, in short, explain, 'And God said, let there be light,' by something like the phrase, '*Again*, thou sayest, *come again*.' Now this seems harsh and forced; yet if (for argument's sake) it were admitted that this solution is the true one, we should in that case hardly expect that a revelation, having the history of God's dealings with men for its great subject, should be introduced with a formal notice of a supposed earlier world;—a matter interesting indeed, as a question of science, but quite unconnected with moral or spiritual discipline. But, without such a *preface*, the difficulty we have mentioned must have occurred, since it would arise, supposing the interpretation correct, not from the *contradiction*, but only from the *silence* of the text.

3. There is the interpretation of Mr. Faber and others, who consider the six days as denoting extended periods. Now, to identify the periods before the mention of the sun with periods measured by that luminary, is as much a stretch of private interpretation as even the extended view. Mr. Faber strongly urges this theory, as bringing to light a very striking *general* coincidence between the phenomena of the succession of organic remains (the oldest rocks having vegetables and testacea, the next larger marine animals and some winged animals, and the latest exhibiting the first traces of terrestrial quadrupeds, the whole antecedent to the creation of man), and the Mosaic record, as to the order of their formation. This *general* coincidence has, however, been by some writers very injudiciously pushed into *details*, as if the succinct Mosaic narrative were adapted to convey a full account of the whole series of natural phenomena. From such injudicious attempts (to use Bacon's trite quotation) *a falsification of religion and a visionary philosophy* can alone arise; and Professor Sedgwick has therefore strongly condemned *such speculations* as *unsatisfactory*, and they have indisposed him altogether to this view, and inclined him to the second.

But in any case there is not the slightest blemish cast upon holy writ. 'By faith we understand that the worlds were formed by the word of God, so that the things which are seen were not made of the things which do appear.' But the detail of particulars may open much space for the exercise of conscientious differences of opinion."

(To be continued.)

AN INTRODUCTION TO ZOOLOGY,

IN ILLUSTRATION OF THE ZOOLOGICAL DEPARTMENT OF THE MUSEUM OF THE BRISTOL INSTITUTION.*

It having been thought desirable to introduce the several subjects embraced by this Journal, by a series of prefatory papers, we shall proceed to carry this plan into effect with regard to Zoology: and for the clearer elucidation of our views, we shall make constant reference to the museum of the Bristol Institution, which, from its extent and richness, and from the convenience of its situation as far as regards our immediate neighbourhood, will admirably serve to illustrate our observations. †

* This introduction had originally been undertaken, and in part prepared, by the Editor; finding, however, as by degrees the subject expanded itself, that it was likely to include more of the details of the animal kingdom than had at first been contemplated, it became adviseable, for the better accomplishment of the whole, to call in the assistance of at least another, it may be of several labourers. The paper will be left, therefore, until its final conclusion, anonymous.

† The collection of the Bristol Institution, that is to say, that portion of it which the dimensions of the building will permit to be arranged, occupies twelve rooms.

The sciences relating to organic life, constitute a very important element of human knowledge; they include the consideration of all organised matter, whether wrought into an animal or a vegetable form, all the curious and beautiful organic structures which present themselves spontaneously to our daily view, as well as those for the knowledge of which we are indebted to the labours of the anatomist and botanist, and to the scrutinising eye of the microscopic observer. Astronomy and Geology are sciences of an expansive character: they calculate the bulk and density of the planets, predict the periods of their revolutions, or exhibit the cataclysms to which our globe has been subjected, and the traces of that chaos and confusion out of which the present order of its materials has been educed. They lead the mind to contemplate the infinitudes of space and time, challenging without hyperbole the highest powers of the imagination, only to shew that even those powers are insufficient.

Anatomy, on the other hand, astonishes us by the minuteness of its wonders, and displays indications of design as cogent and as striking in the

The books, scientific and other journals, papers, maps, etc., are contained in the two *Reading-rooms;* the apparatus, mechanical, hydrostatical, optical, pneumatic, and chemical, in the *Apparatus-room* and *Laboratory*, down stairs; the aquatic birds, and a small part of the local geological specimens are arranged, with the fossil saurians, in the *Committee-room*. In the *Lobby*, *Hall*, and upon the *Stair-case*, are models, casts, bas reliefs, and busts, together with several mummies and mummy cases, and the skeleton of a mummy.

The *Octagonal-room*, above the lobby, contains the skeleton of the larger mammalia, birds, and reptiles; in the cases above are specimens of coral; and below are tatoed heads, and military and domestic implements, from New Zealand; several models, and divers musical instruments.

The *Mineral-room*, opening from the S. W. angle of the great room, contains a good collection of minerals, arranged after the method of Phillips; a small cabinet of rocks, arranged by Werner; a series of organic remains, arranged geologically; several corals, and a magnificent head and antlers of the fossil Irish elk.

The *Upper Room* above this, accessible from the gallery, contains collections of crustaceæ and asteriæ, coins and medals, models of cromlechs, etc.; African and South Sea implements, Chinese and Burman books and MSS. Egyptian idols and scarabæi, and various urns from Deverill Barrow, etc.

The *Zoological-room* is at the opposite diagonal of the great room. It contains skeletons and stuffed specimens of the vertebrated animals. In the gallery is the remainder of the ornithological collection; over the door-way an enormous head of an elephant; and in the centre of the room, the original statue of 'Eve at the fountain,' by Bailey.

The *Great-room*, from which the latter apartments open, contains a suite of casts from the pediment of the temple of Jupiter Panhellenius, at Egina; a frieze from the temple of Apollo, near Phigalia; and casts from the Apollo of the Vatican, the Venus di Medicis, Dying Gladiator, Laacoon, etc., with several smaller figures; a full length picture of Gen. Moore, and the Temptation by Rippengille. The conchological collection occupies the cases in the centre, and around the gallery are the Miller collection of crinoidea, the materials of his celebrated monograph, and various reptiles, fish, and mollusca, in spirits.

composition of an animal so minute as to be invisible to the naked eye, as are yielded by the broad and magnificent survey of the celestial vault. The one draws proofs of Deity from the majestic orrery of the heavens, or the profundities of the earth; the other elevates them from the actual dung-hill, or the blade of grass beneath our feet. We shall make no apology, therefore, for devoting a considerable portion of our future pages to the sciences relating to organic life, or in other words, to animal and vegetable Anatomy and Physiology. These are pursuits which, above all others, are delightful and profitable to the mind; they teach the language in which the hieroglyphics of nature are inscribed, and point out by a series of facts within the observation of all, from what minute details the general result has been deduced, which exhibits the material world as a collection of contrivances, all adapted to uniform ends, and in which Infinity seems to have descended to the level of man, that he might understand and admire. Such pursuits are a perpetual spring of pure and rational entertainment, not merely unobjectionable, but highly to be praised.

But before we can introduce to our general readers, in the description of new species or observations upon an old one, such points in the animal and vegetable œconomy as may appear worthy of their especial attention, we feel that it would be desirable to place before them, as concisely as is consistent with clearness, a view of the whole animal and vegetable kingdom; and this, with respect to the former, we propose to do upon the present occasion, commencing from the bottom of the scale of beings.

As our great object is to make ourselves clearly understood, and to place within the reach of all the means of obtaining sound general information, we shall make use of such materials as may best suit our purpose, or lie nearest at hand. With this view we shall refer for many of our illustrations to Dr. Roget's excellent Bridgewater Treatise, by far the best compendium of animated nature which has yet appeared; and which, from the clearness and simplicity of its arrangement, and the number of its marginal illustrations, is highly and deservedly popular.

The science which treats of the structure of animal organs, of the functions which they discharge, and of the laws by virtue of which they operate; which establishes the relations of animals to each other, and to the exterior circumstances of their life; and which, by appreciating the differences and resemblances between each, affords a ground for comparison and generalization, passes under the appellation of Zoology.

Zoology is therefore a science of observation, and in it are imperatively bound up three subsidiary sciences—Anatomy, by which organisation is displayed; Physiology, by which functions are explained; and Biology, under which falls the consideration of certain phœnomena, dependent upon the general integrity of the whole, and denominated in the aggregate "life."

Zoology, therefore, like all other sciences, is based upon a collection of

observations, the reunion or distribution of which with reference to their relations constitutes a system, and the more numerous the facts observed, the more natural their arrangement, and the more simple and rational the deductions from them, the nearer to perfection must that system be. Classification then depends upon comparison, that is, upon the discovery of similarities and dissimilarities between different individuals composing the animal kingdom, and the arranging these accordingly, first, in groupes, then the uniting under a more general term such of these groupes as are most resemblant, and thus abstracting still further at each step, to place the whole under a regular methodical arrangement.

Now since the basis upon which the whole of such an arrangement rests, consists purely in certain points of difference and analogy really existing in nature between the ultimate groupes, and since the proximate abstractions are all strictly and obviously deduced from them, such an arrangement deserves the term of "natural." It was never invented, it was discovered, and it rests upon a basis so secure, that however imperfect the present state of our knowledge may be, or however numerous and important the observations hereafter to be made, still the general principles upon which it rests can never be subverted.

It is found, by a careful collation and comparison of observed facts, that the co-ordinate members which compose each individual, as well as those composing the whole animal series, are formed with reference to particular purposes; and that in all cases a particular organisation so invariably accompanies particular habitudes, that they readily admit of deduction the one from the other: and it is also found that in all the numerous and varied contrivances which are met with, both in the invertebrated, and more obviously in the vertebrated animals, there is a remarkable adherence to certain types or patterns necessarily manifested, all the varieties being modifications of parts rather than alterations of the whole.

It is a great, though perhaps a common error, to suppose, that in the existing state of our knowledge, "a regular series of beings can be traced up from the lowest monad to man, through a great variety of almost insensible gradations." If this be really the case, there is at least nothing known at present by which it can be exhibited. It is indeed perfectly true that very many links of such a chain do exist, and that with reference to them is determined the relative importance and position of those groupes, whose characteristics had been previously determined; but there appear to be so many breaks, and so many duplicate links, that even with the aid of extinct and fossil animals, nothing like an imperceptible gradation has been hitherto traced.

There is probably no organised being, as Cuvier has observed, of a simple character, all being compounded of certain traits of conformation; and if we wish to distinguish any one being from another, it can only be by collecting all these individual traits, and deciding which of them are

held in common with the beings around, and which are peculiar to the individual. And the more numerous the surrounding beings, the more numerous will be the traits which we must accumulate. So that if we wished to distinguish one being from all the rest, it would be absolutely necessary to give as his character a complete and laboured description of him.

Now it is obvious, that if animals were grouped according to the principles above stated, that is, according to the similarity of their constitution, this great inconvenience would be removed, since the name of the groupe would at once convey to us all the qualities possessed by its members in common, and the peculiarities of the individual, necessarily the smaller portion, might in most cases be expressed in a few words. As this point is of some importance, let us endeavour to illustrate it. Suppose we wished to characterise any animal, say an Italian greyhound; it is obvious that a detailed description of his structure and habits would occupy many pages. Now the requisite information is conveyed to any person, moderately acquainted with the general classification of animals, in a few words :—we say that the dog is an *animal,* of the *division* vertebrated, *class* mammalia, *order* carnassiers, *division* carnivori, *tribe* digitagrade, *genus* canis, *species* canis familiaris, *variety* canis grajus, *sub-variety* canis Italicus. At each step we reject a load of extraneous matter, and narrow considerably the limits within which the animal is contained: 1. He is an animal; this tells us in one word that he digests, absorbs that which is digested, and is thereby nourished. 2. He is vertebrated; that is, he has a back bone, an internal skeleton, an alimentary canal, a circulating and respiratory apparatus, a brain and nervous system, and the five organs of the senses. 3. He is of the mammalia; that is, he is viviparous, and nourishes the young by milk. 4. He is one of the carnassiers, or feeders upon animal substance generally; he has therefore teeth of three kinds, two anterior extremities unprovided with hands, a separate or opposeable digit or thumb, breasts variable in number, a single stomach, a short alimentary canal. 5. He is *carnivorous,* or a feeder upon flesh; he has therefore six incisor teeth in each jaw, powerful canine, and cutting molars, sometimes tuberculated, but never crowned with angular projections or points. 6. He is digitigrade, or walks upon the points of his digits. 7. He is of the genus canis, and possesses therefore anterior feet, with five digits; posterior, with claws not retractile; tongue soft. 8. His species is canis familiaris, whose characteristics are a curved tail, a snout more or less prolonged, and coat varying in the nature of its hair and in its colour. 9. He is of the variety canis grajus, or greyhound, possessing elongated snout, long and delicate legs, abdomen suddenly contracted, and coat silky; and finally, he is of the subvariety canis Italicus, or Italian greyhound.

Now a description, much fuller than the above, is expressed by the naturalist in the single specification "canis grajus," which implies all the

preceding terms, and leaves only a necessity for the addition of a few points respecting the particulars in which the animal differs from those of his variety.

The distinction of species then, as the term is generally at present adopted, rests upon modifications of organs of the least importance to life; but still it is upon the accurate determination of these differences that the whole superstructure of order and class depends, and by attention to them and careful comparison of them with peculiarities of a similar character in other animals, that species are erected into *genera*, genera into *orders*, orders into *classes*, and so on; the difference between each abstraction increasing according to its distance from the original group, being at its minimum between one species and another, and at its maximum between the two principal divisions of animals, the vertebrated and the invertebrated.

When the relative importance of each system of organisation, composing the animal series, and the value of the organs of each system with reference to each other, is thus determined, it becomes easy to assign to any given animal or organ the place it should occupy in the great animal scale; and since a certain amount of difference is alone necessary to constitute a distinctive groupe, it is obvious that neither species nor genus are at all dependent upon the number of animals composing them, the existence of a single animal being sufficient to form either the one or the other, without reference to its size or importance.

Before we proceed to consider somewhat at length the conditions of all, and more particularly of animal life, we shall, to make our sketch less incomplete, say a few words respecting the material upon the organisation of which those conditions depend; in fact, to shew how the tools are made, before we consider the work which they have to execute.

The original or *ultimate* elements of which organic animal matter is composed, and into which it may by destructive distillation be resolved, are carbon, oxygen, hydrogen, and nitrogen, besides certain other undecompounded substances, which are too irregular in their appearance, or too minute in their quantity, to deserve a place in a sketch like the present.

A milder method of analysis gives us those elements in their first and simplest combinations, as gelatine, albumen, and fibrine, and some others of less importance, the materials out of which the organised body is immediately formed, and which are termed accordingly its *proximate* elements.

All those are included under the term of *chemical* organic constituents; and their combinations differ not only in chemical composition, but in mechanical structure; and being separable by the scalpel of the anatomist or other mechanical force, are called the *anatomical* elements.

Anatomists have long sought after the ultimate anatomical element into which all structure might be resolved, but their search has not been very successful. This element is generally considered to be a fibre, of the size

of which we are ignorant, but which, though of course not itself organised, makes up, by its conjunction with similar fibres, organic matter; and which therefore may be said to be alive, since that which is formed by its union is possessed of life.*

The solid structures of the body may all, by careful maceration, be rent into fibres; the fluids, the proportion of which in the human body is said to be to the solids as nine to ten, when examined beneath the microscope, appear to be composed of globules.

Membrane is the basis of all the solid structures, and is considered as the simplest modification of the ultimate fibre. It is the most diffused of the textures; it forms the external and internal coverings, both of the whole body and of its constituent parts; is the basis of the osseous system, giving form to the bones, and a nidus for the deposition of their earthy secretions: it envelops the muscles, dips down between their fasciculi, encloses the blood vessels and nerves, and forms by far the larger share of the cartilages, tendons, and ligaments. Many of the internal cavities are almost entirely formed of it; as mucous, it lines the mouth, fauces, and alimentary canal, and all other open cavities; as serous, it envelops the viscera, applies itself to their exterior surfaces, and by its lubricated interposition prevents their adhesion to one another; as fibrous, it forms the capsules of joints, and surrounds the brain of the mammalia; and as cellular membrane, it forms the cushion upon which the integuments rest, and which gives form and grace to the outline of the figure. We are informed by Blumenbach, that so universal is the presence of membrane, that the enamel of the teeth is the only structure in which it has not as yet been detected. The fibres are disposed differently in different membranes. In the fibrous membrane, they are not disposed in parallel rows, but are curiously interlaced and woven, and such membranes are consequently inelastic, and they would otherwise be useless. When elasticity is required, as in the ligamentum nuchæ, retractile structure of a claw, &c. the arrangement of the fibres is different, and more nearly parallel.

The combination of the anatomical principle, which is considered after membrane to be most simple and is most abundant, is muscle, or as it is commonly called, flesh. In whatever other respects, as of firmness, colour, &c. muscles may be dissimilar, they all agree in this, that they are fibrous, and admit of being readily torn asunder into fasciculi and subfasciculi, to con-

* Les anciens croyaient que tous les solides organiques peuvent être ramenés, en dernière analyse, à une fibre simple; ils la supposaient formée de terre, d'huile et de fer. Haller, qui admettait cette idée des anciens, convient que cette fibre n'est visible que pour les yeux de l'esprit: c'est comme s'il avait dit qu'elle n'existe point; et c'est ce dont personne ne doute aujourd'hui.—Magendie, Prec. El. p. 4.

"Invisibilis est ea fibra: sola mentis acie distinguimus."—Haller, Elem. Phy. tom. II.

This is a good instance of the prevalence of the slipshod philosophy of that day, which could lead even a man like Haller to advance such nonsense.

siderable minuteness, until beneath the microscope one is arrived at which admits of no further subdivision, and which is therefore considered as the *primary muscular fibre,*—not however to be confounded with the still more minute *ultimate fibre* before alluded to. The primary filament of muscle is said to be about the diameter of a globule of the blood.

The peculiar property of muscle, which fits it for its office, is contractibility, by which property the lateral expansion of the muscle is caused, the two extremities are approximated, and the parts with which they are connected are thrown into motion.

Muscles terminate usually in inelastic strings or tendons, by means of which their forces are exerted upon distant points, and the bulky substance of the muscle permitted to occupy any position which may be most suitable. It does not suit our present limits to enter into the various forms assumed by muscles, nor into the laws under which they act; we may, perhaps, recur to them at some more convenient period.

Osseous matter is the next combination of which we have to speak. It has been considered by many only as condensed membrane. Its appearance as bone, crust, and shell, is familiar to every one. It is a hard unyielding substance, perhaps the only one, strictly speaking, solid. The calcareous case secreted by the zoophytes, the shells of the testaceous mollusca, the crusts or armour of crustacea, (lobster, &c.) and the phosphatic bones of the higher animals are all of this nature. Osseous matter forms the basis of the frame, the points from and against which most of the muscles act, the defence of the soft part, and the usual support of the organs of locomation. In the lower animals this matter is exterior, in the higher interior to the soft parts.

The last and highest combination of which we shall speak, is the cerebral substance. This is an ash grey, or white medullary substance, of but little firmness, and forming the brain and nervous system. Its ultimate anatomical structure is involved in much obscurity, though it would appear from the observations of Prochaska, the Wenzels, and M. Bauer, as cited by Bostock, that this structure is globular.

We have thus enumerated four principal combinations of the ultimate anatomical element, by the modification of one or other of which every solid structure in the body is supposed to be formed. We shall next say a few words concerning the composition of the principal fluid, the blood.

The fluids entering into the composition of the animal body, are very numerous in kind, and constitute a very large proportion of it; so that a human body weighing eighty pounds, having being dried in an oven during seventeen days, was found, upon being withdrawn, to weigh only twelve.

In the lower animals there is no apparent distinction of the fluids, but as we ascend in the scale, we find fluids of a totally distinct character connected with the different functions of the body, and all, however dissimilar, secreted from one parent fluid, the blood.

The blood, then, becomes a fluid of immense importance in the animal œconomy, and to its formation, circulation, and renovation we shall shortly see the principal solids of the body to be directly subservient.

The blood varies considerably in colour, consistency, temperature, and composition, in different animals; or under different circumstances in the same animal. It is either white or red. In the crustacea and mollusca, it resembles a gelatinous lymph, totally dissimilar to that fluid which we recognize as blood in the higher animals, but assuming, upon evaporation, somewhat of a fibrous structure. In the insects, the blood is also colourless; but in certain of the annelida, it is red. In the vertebrated animals, fishes, reptiles, birds, and mammalia, the blood is also red; but in the two former it is not readily coagulable, nor does the coagulum, when formed, bear any considerable proportion to the rest. In the birds and the mammalia, the blood is red, highly coagulable, and forming a large and firm fibrous coagulum.

The blood of the higher animals is found to exist under two conditions; before it has been submitted to atmospheric influence in the lungs, and afterwards: being in the former case of a florid colour, and termed arterial; in the latter, of a dark purple, and termed venous. The latter, however, upon exposure to the atmosphere, assumes gradually the arterial hue.

The blood of the higher animals, when permitted under ordinary circumstances to stand, separates into a central coagulum or clot, the *crassamentum,* and a surrounding straw-coloured fluid, the *serum;* and if the clot be submitted to the action of water, the colouring matter is washed out, and the mass remains of a tough fibrous consistency, and a buff gray colour. This substance is the same with that of which muscle is composed, and is called *fibrin.* The serum is found to consist almost wholly of albumen, which coagulates on the application of heat or an acid, and leaves an uncoagulable fluid termed the serosity of the blood. If that portion which, as colouring matter, has been washed out from the crassamentum, be submitted to the microscope, it is found to be composed of a number of bodies more or less spherical, called the "globules of the blood."

In the lower vertebrated animals, as the fishes and reptiles, these globules are of larger size than in the mammalia, and their figure is oval; and in some cases it is said to be lenticular. The size of these globules in the birds is still larger, and their form oval; in the higher animals they are circular, and gradually diminish in size, being at their minimum in some of the mammalia.

These globules are described as consisting of two distinct parts; a transparent vesicle, and a central solid body within it.

The temperature of the blood, like that of the animals in whom it flows, is variable; all, it is probable, possess more or less animal heat, but the quantity in the lower animals is too minute to be appreciated by our ordinary means.

Those animals whose powers of producing heat are feeble, and whose

temperature consequently varies with that of the medium in which they move, are called "*cold blooded;*" while the *warm blooded* are those who, on the contrary, preserve a temperature uniform, or nearly so, without reference to the temperature around them. The reptiles and fishes, and all below them, are of the former description; the birds and the mammalia are of the latter.

Having considered the four principal solids, and the all-important fluid of the animal frame, by means of which the great businesses of that frame are carried on, we shall add a few words concerning their appearance in different tribes of animals, and then pass at once to the businesses or functions which they execute.

The lowest animals are composed of gelatine; they inhabit water, and cannot be said to exhibit, though they may retain life out of it.

A step higher, and the gelatinous cellular texture, of which the inferior grade was composed, is not found firm enough for the increased wants of the animal, and to this therefore is superadded albumen, a substance which gives the requisite firmness, and which though perfectly flexible is tougher and stronger than gelatine. Fibrous membranes are composed of a combination of albumen with gelatine, and they contain a proportion of albumen increasing with the strength required.

When gelatine almost entirely disappears, and the structure is formed of albumen, combined with a small proportion of calcareous matter, it is called cartilage, a dense substance, containing usually no fibres, and of a white or bluish white hue. It forms the skeleton of the lower, or, as they are called, the cartilaginous fishes, (shark, ray, sturgeon) of very young mammalia, and parts of that of older ones. The articulating extremities or joints of the bones are tipped with it; lines of it connect the lower ribs with each other and with the sternum, and it forms part of the windpipe and organ of voice, together with the prolongation of the fauces and nostrils.

Where cartilage is found from its flexibility to be insufficient, a harder and more earthy material is employed. Where this earthy matter is carbonate of lime, as in the testaceous mollusca, it is exterior to the animal, and is called shell. When it is in part carbonate and in part phosphate of lime, with a predominance of the latter, being still, as in the crustacea, exterior to the animal, it is called crust. And where, as in the higher fishes, reptiles, birds, and mammalia, it is almost entirely phosphate of lime, and forming an internal skeleton, it is called bone.

Having considered the material out of which the organs are wrought, we shall next pass to their functions.

All organic life, whether animal or vegetable, necessarily implies two essential conditions; these conditions are nutrition and reproduction:— nutrition, by which it appropriates materials for the growth and development of its parts while in a growing, and their sustentation in a mature state; and reproduction, which by the primary law was impressed upon the

very first herb called into existence, and so constituted as to yield seed after his kind, thus propagating the species, while the individual perishes, and so renewing from time to time the occupants of the face of the earth.

The process of nutrition requires, first, the introduction of a specific nutritive fluid; secondly, the bringing that fluid into contact with the vivifying influence of the air; thirdly, its dissemination through the several parts of the system; and fourthly, its assimilation and conversion into various forms, each differing very materially both from its original condition and from the others, but accommodated according to its relations to the parts which it is destined to renovate.

These four processes, or stages, are in vegetables exceedingly simple, but in animals much more highly complicated; because in vegetables the nutritive fluid or sap, being in its original state only water, holding in solution a number of earthy, and saline, and gaseous particles, is readily furnished by the soil from which they grow, and needs not, as in animals, be concocted by a long course of previous preparation. The water thus laden is absorbed by the spongioles, or spongiform extremities of the roots, and rises through the stem, (or rather, through the void spaces, between the minute cells of which the porous substance of that stem consists,) partly by the mere mechanical action of capillary attraction, and partly, it is probable, through the vital contractibility of the mass.

The aeration of the sap is conducted in the leaves, which may therefore be considered as vegetable lungs; for this process of aeration is remarkable both for its analogy and for its opposition to animal respiration, by means of which, by a most admirable adjustment of nature, the antagonist (if we may so speak) modifications of a similar function, are constantly made to balance one another in their effects upon atmospheric air, upon which both act, and thus tend to preserve it in that state of uniformity which is among the most necessary conditions of nature. For in the animal lungs, the oxygen inspired uniting with the carbon, with which the venous fluid becomes surcharged in its passage through the system, abstracts it in the form of carbonic acid gas. In this state the air soon becomes unfitted for further inspiration: but that which thus converts it into a poison for animal life, accommodates it as a rich source of nourishment for vegetable life, for carbon forms the principal sustenance of plants: during the presence of the light of day, the leaves have the power of decomposing the carbonic acid wafted to them by the atmosphere, thus tainted by animal respiration, and restoring to it the pure oxygen; while the carbon, being placed apparently in a state of atomic division, which fits it for uniting with vegetable compounds, is absorbed into the vegetable circulation, at the moment when it is in a state of nascent disengagement from its former union with oxygen; and although, when the solar light is withdrawn, the leaves, losing this power of decomposition, can only absorb the oxygen and unite it with the carbon which they contain, yet their former energy is

recovered at the dawn of day, when they at once proceed to decompose the stock of carbonic acid that has accumulated during the night, in addition to the fresh supplies continually afforded to them from the source above specified, and thus send forth pure streams of oxygen, fitted for the purpose of animal respiration, thence to return to them fraught with the carbon they require in this wonderfully adjusted circulation of nature.

The sap then, thus modified by the additional quantity of the great vegetable nutriment, carbon, which it has acquired, and now being altogether analogous in its functions to the blood of animals, descends from the leaves, through the intercellular spaces of the innermost layer of bark and outermost of the wood, and deposits in each part that it traverses, the materials required for its development or support; while by vital powers, analogous to those which reside in animal glands, it is made to yield at particular points the specific secretions and products required, whether gummy, saccharine, amylaceous, or ligneous.

Such is the simplest form of vital nutrition, that which prevails in the vegetable kingdom; having traced which, we shall proceed to its more complicated relations in the animal kingdom.

Animals do not, like vegetables, immediately imbibe the nutritive fluid from the surrounding elements, in a state of nearly perfect preparation from the first, but they have to derive it from the animal or vegetable substances on which they feed, by a long train of previous preparation and elaboration, which is called the digestive process. Digestion is carried on in the alimentary canal, which for this purpose is expanded into cells called stomachs, and thence protracted into a long intestinal tube, contorted in order to pack the greatest length into the smallest space. The food passes from the mouth through the gullet, or æsophagus, into the stomach, being first comminuted either by the teeth of the mouth, or in some instances by muscular gizzards, or small bony masses, accommodated for the purpose, and placed in an introductory stomach. In the true stomach the food thus presented is dissolved and digested, by the chemical action of a specific fluid, the gastric juice, secreted in the glandular structures of the coats of the stomach, at the commencement of its passage through the intestine.

In all except the very lowest animals, the nourishment becomes mingled with other peculiar fluids, the bile secreted by the liver, and generally with a second fluid, the pancreatic juice from the pancreas. The nutritive portion of the food thus becomes converted into a peculiar milky fluid, called chyle, nearly agreeing in its chemical composition with blood, while the non-nutritive portion is prepared for excretion. In the lowest animals, however, as the zoophytes, mere digestion in the stomach seems to be all that is required, the nutritive fluid becoming thus properly prepared, and ready, as it appears, to be absorbed and diffused through the pores of their mass, for they are supposed to be destitute of any regular apparatus of

vessels;—we say supposed, for it is more than probable that our knowledge of the internal structure of the lower zoophytes is but in its infancy. With regard to the infusorials, or animals of infusions, for the most part microscopic, the researches of M. Ehrenberg have shewn that their organization was far more elaborate than had been supposed; and in them he has discovered not only stomachs and an alimentary canal, but what he considers as analogous to the liver and pancreas. But we shall return to this hereafter.

Advancing a step higher, we find in insects and the testaceous or shell-inhabiting mollusca, a regular hepatic system for the secretion of bile. Now the chyle thus prepared is next to be absorbed into the system. In all the vertebrated animals, the great absorbent system is divided into two parts, and the branches of that peculiar one called the lacteal, are distributed along the voluminous convolutions of the intestine, in order to the taking up of the chyle; but in insects, mere transudation into the pores of the general system seems to be the first step, although the rudiments of a vascular system of circulation are even here partially to be traced out. In the testaceous mollusca, (although in their organs of sense inferior to insects,) the whole system of the circulation exhibits a nearer approach to that of the higher classes, though the ordinary veins seem to discharge the functions of the absorbent, which are therefore not found to exist as a distinct system. Where this system, these lacteals, are present, their ramifications at length uniting in one trunk, pour the chyle into the great vein of the system, and thus bring it up to that step of the circulation which is immediately preparatory to its being submitted, in its further course, to the process of aeration.

Aeration is absolutely essential to life, all forms of which, even the very lowest, would without it become extinct. Nor are even aquatic animals an exception to this, though apparently inspiring a different element; for it is the atmospheric air intermingled with the water which they breathe; and if this air be by any means abstracted from the water, the animals inhabiting it will die. Even in ponds long frozen over, fish cannot support existence, and will be seen flocking round any hole which may have been broken in the ice, while life still remains. But although aeration is necessary for the support of all life, it is an end accomplished in different orders of animals by very different means.

In the lower zoophytes, (which are all aquatic,) the nutritive fluid, in generally percolating the pores of the system, seems to require nothing more than the mere contact of the aerated water, along their general external surface. But in insects, though the nutritive fluid is equally diffused, a far more elaborate system of aeration is provided; their bodies present ranges of numerous circular orifices, each opening into the tube of a trachæa, which branching out into multiplied ramifications, thus pervades the whole mass. It has been well said, with reference to this structure,

that here the blood is not, as in other animals, necessitated to go in search of the air, since the air comes in search of the blood.

The system of circulation then, begins in insects, and this is so intimately connected with the conveyance of blood to the organs of its aeration, that we must bestow a few words upon that subject.

This system requires that the vessels conveying the fluid should be furnished with a series of valves, favouring its passage in one direction, and impeding or opposing it in the contrary; and that to such a vascular arrangement should be superadded a muscular power, which by a series of alternate pulsations of contraction and dilation—a systole and diastole—should create and preserve an impulse of motion to the sanguinic currents. Such a power may of course reside in the whole length of a continuous vessel, or it may be concentrated upon a circumscribed portion of it; one or more sinuses for instance of a muscular structure opening into the principal vessels; or the power of contracting may reside in both. The muscular organ in the second of these cases is called a heart. A *heart*, speaking generally, is composed of two sinuses, by one of which, the auricle, it receives the blood from the system by the main vein; and by the other, the ventricle, it propels the received blood into the system, through the main artery, the aorta. In the higher animals, the mammalia for instance, this organ is always double, possessing two auricles and two ventricles. Insects have no heart, properly so called. In place of it they have a long contractile and pulsating trunk extending along the back, and thence called the dorsal vessel. This vessel, by a happy arrangement of its fibres, propels the blood from its anterior, and imbibes it by its posterior extremity; the blood thus impelled returning from the former to the latter in its course through the general pores of the system. Such an arrangement is called a "diffused circulation," in contradistinction from that which is carried on by perhaps more circumscribed channels and conduits of distinct vessels. Besides this general diffused circulation, however, which conveys the blood in rapid motion between the numerous ramifications of the trachæa, for the purposes of aeration, insects have also lateral blood vessels, sending out loops to the wings, antennæ, &c.; and uniting with the opposite extremities of the dorsal vessel, so as to form distinct channels participating in the same current with the generally diffused circulation. We have not as yet, however, any aorta or main arterial trunk issuing from the ventricular division of the heart, and thus successively ramifying into thousands of smaller branches, conveying blood even to the minutest portions of the body, where they meet extremities of the veins which imbibe the vital streams and carry them backwards, conveying and becoming confluent into larger trunks which at length unite in the grand venæ cavæ, by which the blood is restored to the heart through its recipient ventricle. For such is the higher system of circulation to which we are gradually approaching.

The arachnida, who form the next step to be ascended, possess connected

with the dorsal, or as it may justly be called the cordal trunk, a more perfect vascular system of circulation; and as this affords facilities for carrying the blood to particular localities for the purposes of aeration, the all-pervading ramifications of the numerous tracheæ are no longer found; but in their place four pulmonary cavities communicating with the external air on either side, and covered with ramifications of blood vessels, which issue from the cordal trunk, and thus expose the blood within them to the action of the atmosphere. Such cavities are in fact lungs; and thus we find in the arachnida the simplest form of lungs for direct aerial respiration.

Nearly allied to the arachnida are the crustacea, in which the system is still further advanced.

In the crustacea we have, not only the arterial system spoken of, but the two great venous trunks; these venæ cavæ, ranging on either side, send out subsidiary branches which issue in innumerable ramifications, spread over a fringe-like or filamentous structure, one of each of the fringes being attached to the haunches of each of the thoracic feet. This constitutes a gill, the common organ of aquatic respiration, by which the water charged with air, is brought into contact with a thousand minute vessels, whose expanded structure thus exposes a very considerable aggregate of surface to its influence, and thus accomplishes the ends of aquatic respiration. Such aquatic organs, or gills, only differ from aerial lungs, in that the membranes upon which the vascular ramifications are conducted, are in the latter case wrought into a congeries of minute cellules, into the interior of which the ultimate ramifications of the trachea open and admit the air. As to the precise mode of communication or contact between the air and the circulating fluid, we are not called upon now to deliver an opinion. The matter is a curious one, and will probably form the subject of a separate paper.

In the crustacea, the branches sent out from the venæ cavæ to the gills or branchiæ, dilate at their origin into muscular contractile sinuses, accelerating the current of the blood, and therefore to be considered as so many branchial hearts, the vessels springing from them being in fact the pulmonary arteries; and as these arteries diffuse the blood over the laminated structure of the gills, so the corresponding veins convey the blood back again after it has undergone the changes attendant on aeration, and deposit it finally in a concentrated form in a large oval cordal vessel. In the lobster this vessel begins to assume the character of a true heart, dispersing its blood by means of an aorta and arteries, in an aerated condition, through the system, and affording a very perfect type of ordinary branchial respiration.

We may here, in proceeding, observe how impossible it is to arrange the animal kingdom in any thing like a linear series with reference to the gradually advancing perfection of development of these functional organs; and how loose is that theory which would regard the species as having

been, as it were, educed out of each other by a development successively progressive; and indeed we shall find not at all a single linear series, but rather different parallel series, each exhibiting a correspondence of ultimate results, although the intermediate steps of each are widely dissimilar.

Thus in the insects, beings whose organs of sense are very far advanced, and who evince instincts very highly developed, we have traced from its first imperfect rudiments, a system of vascular circulation, with a heart as its motive power, and regular organs of respiration. But if we take a step, which, to every mind not prejudiced by the shackles of artificial system, must seem a very great descent, to the bivalve mollusca; the oyster for instance, affixed for life to a single spot, destitute of every organ of sense, and manifesting no higher instinct than that which directs it to open its mouth for the reception of its food; we shall find, in this low animal, the whole system of circulation and respiration far more analogous to that of the higher orders, than they are in the ant or the bee; and yet these are beings upon whose social and moral history, as it may justly be called, there is room for volumes.

In the acephalous, or headless bivalve mollusca, we find the gills or branchiæ ranged in four lamelliform fringes round the margin of the body, the mouth opening on one side under the hinge, and the vent on the other, the veins collecting the blood from the system generally, and the nutritive chyle from the intestines, conveying the mingled stream to the heart, from whence it is again to be disseminated by the arteries through the system.

Among many of the univalve mollusca, higher and more advanced animals, a similar arrangement is found to prevail. These animals possess a distinct head, provided with organs of vision; but many of them do not breathe water by gills, but air by a regular pulmonary cavity or apparatus of lungs, resembling in every thing but the number of the cavities, here only one, the organ described for a similar purpose in the arachnida.

Looking back then upon these classes of animals, we see nothing like a regular progression from aquatic to aerial respiration; but the most nearly allied genera of the same family are provided with one or the other as accommodated to their intended stations, exhibiting every where the direct intervention of an Intelligent appointment and design, varying its means according to a varying end, and displaying nothing like the constant and invariable sequence which marks the blind operation of merely physical causes.

In the cephalopodes—the cuttle-fish family—are found three hearts; two branchial sinuses, receiving the blood from the venæ cavæ, and transferring it to the branchiæ, whence it proceeds by the branchial veins to a third or central heart, by which it is diffused through the aorta over the system—an organisation very analogous to that of the crustacea. The cephalopoda possess organs of vision as highly organised as those of the fishes. In

them is also observed the first trace of a regular organ of hearing, and they are in many respects very highly advanced.

In the fishes, the only circumstance to be observed with respect to their circulation is, that they have only a single or simple heart; and this prime mover of the system is placed between the great venous trunks of the body, the venæ cavæ, and the artery leading to the gills; so that this is a purely branchial heart. By the branchial veins the blood is re-collected into one common trunk, the prolongation of which, however, must be regarded as an aorta; for although no second muscular heart intervenes in these animals to accelerate the circulation, the ramifications into which the vessel divides and subdivides, diffuse the blood through the system, by virtue of the impetus communicated by the mere contractile force of the vessels themselves.

Reptiles possess also a single heart, but in them the main artery immediately divides; one branch passing off, as the great pulmonary artery, to ramify in the lungs; and the other, as the aorta, being destined for the supply of the system. Thus therefore in these animals a fractional part only of the blood is made to undergo, at every round, the process of aeration.

In the mammalia the heart is double, a distinct pulmonary and an aortal heart being associated in juxta-position as a compound organ, of which the former occupies the right, and the latter the left side. Here the venæ cavæ convey the collective blood of the whole system, mingled with the chyle previously absorbed by the lacteals from the intestines, into the right auricle, through the valve of which it passes into the right ventricle, thence to be propelled through the pulmonary artery into the lungs. From the lungs the aerated blood descends by the pulmonary veins into the left auricle, and flows through its valve into the left ventricle, which, by the firm contraction of its powerful museular walls, urges it through the main conduit of the aorta, on its course through the whole system.

There are many beautiful contrivances subsidiary to the ends of the circulation, into the mention of which we cannot now enter; they must form the subject of future communications.

We have thus traced the whole process of the preparation, aeration, and diffusion, of the nutritive fluid. How this homogeneous fluid becomes assimilated and converted into such various and dissimilar substances, depositing in one place calcareous phosphates and carbonates, as bone and shell; in another, fibrine and gelatine, for the membranous and fleshy textures; or why, being conveyed into one gland, it should issue in a fluid, such as bile; or in another, assume the totally opposite character of milk; is an inscrutable mystery, and most probably will ever remain so. These are phænomena which can only be simply stated; they admit not explanation; they are part of—

——— "Nature's chemistry,
By man's weak art inimitable."

by his limited faculties altogether incomprehensible.

In the general principles of all that class of functions which we have hitherto considered, those merely connected with nutrition, and including the aeration of the nutritive fluid, its diffusion through the system, and its conversion into appropriate substances; animals, as we have already observed, only participate in functions which are involved in the necessary conditions of all life, and are therefore also common to vegetables. But since, as we have already seen, animals do not derive that nutriment at once from the surrounding elements in a state of nearly complete preparation, but from diverse kinds of food which require a preliminary apparatus of concoction; from this, and from similar causes, a still more important and marked difference, which in fact constitutes the essential distinction between animal and vegetable life, namely, the necessity for the superaddition of voluntary motion, perception, and volition, to originate and direct those motions, arises. For since the animals have to provide themselves with these articles of necessary food, the very possibility of their continued existence requires, that they should be gifted with powers which may enable them to detect, to apprehend, and to convey into their alimentary canal, the substances which they are destined to convert into nourishment. We may therefore next proceed to consider these powers; and first, we may review the mechanical instruments of those motions; the muscular, and its support, the osseous system; and then proceed to the nervous power, the seat of that perception and volition which elevates the animal frame, from a mere material to a vital structure, and causes it to become "this sensible warm motion." Here, indeed, the power is in itself the most profound of all mysteries, but we can nevertheless investigate the material nervous organisation with which it is obviously connected.

The prime moving power of the animal system, is that which is denominated the contractility of its parts. The illustrations which we shall proceed to give will, we believe, be found in some degree original, and as such, we particularly invite to them the attention of our readers. Its organs are fasciculi of fibres, called muscles, in all but the very lowest orders of animal existence; and we must postpone our remarks on these till we have first considered the function where the mechanism by which it acts is more palpably displayed. Such a fasciculus may well be represented by a skein of thread; and muscular contractility would be illustrated by a close analogy, if we were to connect such a skein with the conductor of an electrical machine: the fibres would in that case be made strongly to repel each other, and a consequent change in its dimensions must ensue; if it were suspended vertically with a weight attached by a string to its lower extremity, the repulsion would cause a divergence in the breadth of the threads, which would shorten the length of the skein, and raise the weight by the string. Here the skein will represent the muscle, the string the tendon, and the weight the limb to be moved. Again, the skein might be

arranged circularly, to represent circular muscles; and every various combination of the muscular fibres which takes place in nature, might be equally exhibited; and models might be constructed which would imitate by electricity every variety of muscular action—the experiment would be easy and highly illustrative: for the power conveyed by the nerves to the muscles is clearly a power inducing a natural repulsion of their fibres, and many reasons may lead us to believe that it is very nearly connected with those electro-galvanic forces, which, as every one knows, furnish such violent stimuli to muscular action.

In the very lowest animals, such as the polypi and medusæ, (jelly fish) we do not see distinct fibres, but only a uniform gelatinous substance; here, however, we still observe contractility, and consequent motion of the parts—how is this produced? Must we not conceive that the minute internal structure of this gelatinous mass is really cellular, and that the cellulæ are arranged in linear series, and in their relaxed state elongated. Repulsive powers, communicated to such a texture, would naturally convert each cellule from an elongated ovoid into a spherical form, and thus necessarily shorten each linear series of those cellules. This view, indeed, has, we believe, never been taken by previous writers, and we therefore offer it with diffidence, as a mere suggestion. The difficulty, however, of which this solution is submitted, belongs only to an almost insensible fraction of the animal kingdom, for the distinct fibrous structure is already manifest in the actiniæ, a race scarcely distinguishable from the polypi, and it pervades all the orders above this very low point: henceforth, therefore, the mode of action becomes simply mechanical, and perfectly obvious.

The power being thus obtained, its application is principally varied according as the animals possess any solid frame work, which may afford on the one hand firm points of support for the attachment of the muscular fibres, and fulcra, or originating points, to which this action is to be referred; and on the other, levers on which that action is exercised; or, as those animals are entirely composed of a soft and pulpy mass. In the latter case, however, the muscles, by proceeding in a radiating form, from a common central point, or being disposed in a circular arrangement, may produce considerable varieties in the conformation of the parts and motions resulting, but far less than when the solid parts of attachment are present.* Such points are afforded in the bivalve shell fish by their

* The means of locomotion thus afforded, are as various as the wants of the different animals, and manifest the marvellous riches of creative design, in producing the same great ends by such a diversity of means. Some animals, species of zoophytes and bivalves, for instance, do not require any change of place, but are sufficiently supplied by the prey which the element wafts within reach of their mouths or tentacula; these remain fixed. Others have a projecting muscular organ, more like a tongue in its structure, though called from its use a foot; by contracting and dilating this organ, they draw or push themselves along. Some bivalves (the scallop)

external shells; the muscles thus attached are however merely confined to the operation of closing those shells which the elastic ligament joining the hinge would else keep expanded. In the spiral univalves a consistency is imparted to the greater part of the animal, closely attached by its integuments to the convolutions of the solid testaceous envelope. In the annelida, (earthworms, &c.) we have a series of horny rings, forming a kind of external skeleton; in the insects and crustacea, the horny integuments investing each segment, exhibit the most perfect form of this external skeleton; the hard sheaths covering the distinct joints of the extremities, the legs, &c. are very analogous in form, position, and various modes of articulation, to the corresponding parts of the vertebral skeleton, and afford an equally perfect mechanical system of levers. The same end is to be answered, and the manner in which many different modifications of structure are made to accomplish one and the same end, is among the most striking proofs of the inexhaustible riches of creative providence.

In passing from the crustaceous to vertebral animals, we might at first be tempted to suppose that we found a connecting link in animals like the tortoise, where the osseous skeleton is still principally external, the ribs, &c. being connected with expanded integumental plates. But here again, if we compare general functions and structure, we shall find nothing like gradual transition, but instead of it an abrupt leap over a vast intermediate chasm. In the vertebrata, indeed, we see the system of an internal skeleton developed, from its very first rudiments in the sucking fishes, the myxine and lamprey, in the former of which we have the first rudiment of a vertebral column in a simple cartilaginous tube, with scarcely any trace of division into separate vertebral rings. Along the upper surface of this, the spinal nervous chords proceed, protected only by a thin membrane, the whole being more analagous to the cartilaginous lamina found in the cuttle fish, than to any other animal type. In the lamprey, this cartilaginous tube becomes distinctly divided into vertebral rings; in the sturgeon and other cartilaginous fish, each ring gradually expands its inner margin into a thin edge, leaving at first only a narrow central opening for the intervertebral gelatinous fluid, and at length quite closing it, and dividing the intervertebral spaces into perfectly distinct cells; and at the same time, by the development of cartilaginous processes on the upper portion of each vertebra, here affords a protected canal for the conveyance of the spinal marrow. In the osseous fishes, these cartilages become perfectly ossified; and in the reptiles and mammalia, the expansion of the central portion of the bodies of the vertebræ nearly obliterates the intervertebral spaces, leaving room only for the membranes which attach the vertebræ into a united column.

propel themselves by rapidly closing the valves of their shells. The biphori, a race of acephalous mollusca, without shells, by sucking in water at one extremity and forcing it out at the other, move themselves rapidly forward on the principle of a rocket. Worms crawl by the elongation and contraction of their annular segments. The motions of insects and vertebrata are fully illustrated in the text.

There prevails a remarkable unity of design throughout the whole series of the vertebrated animals, including fishes, reptiles, birds, and mammalia; in all we recognise an identity of general structure in the skull and vertebral column; in all, except the apodal serpents and fishes, we recognise a similar conformation in the locomotive extremities, bone for bone admitting of being pointed out, though developed in very different proportions.

Thus the same elements are, by a wonderful adjustment of modifications, made to constitute a fin in the whale, a paddle in the turtle; to support a membranous wing in the bat, and a feathery one in the bird; in beasts of prey, to afford the organs of rapid pursuit, of tenacious grasp, and of power to rend in pieces by the sharp retractile claws with which it is armed; and in man, to provide that wonderful instrument, effective of all other instruments, the human hand, co-ordinate with human reason. In every case we see, indeed, a necessary harmony existing through the several parts of the animal frame: a carnivorous stomach evidently requires organs very different to sieze its appropriate prey, from the cloven hoof of the innocent graminivorous ruminantia. And not the extremities only, but many other portions of the skeleton must be modified so as to afford adequate attachments to the muscles destined to move those extremities; and the teeth have evidently the same relations. Hence what are called the laws of the co-existence and co-relation of the several parts of the animal frame, which are so very perfect, that from a single fossil fragment, the mere joint of a toe, perhaps, we are able boldly to pronounce as to the class and order to which the original has belonged.

In fishes, the pectoral and ventral fins appear to represent the four extremities of quadrupeds, but are very differently organised; and the support of the gills require a peculiar set of osseous arches, and they are covered by another peculiar series of flat opercular bones: but to represent these, as Geoffroy St. Hilaire has done, as developments of the internal little ossicles of the ear of mammalia, is to violate every analogy of form, relation, or function, and to substitute arbitrary canons, which may make any thing out of any thing, and can only lead to conclusions of the most gratuitous absurdity.

The extremities are partially or wholly dispensed with. Partially in the whale tribe, which, being mammalia destined to the life of fish, do not require and are therefore not furnished with the hinder feet:—wholly in serpents, whose ribs are so constructed as to enable them to crawl on their extremities. In some of these, however, rudimental traces of the legs and feet may be seen; in others they entirely vanish.

As we have seen the ribs employed as instruments of progression, so in the draco volans we find them expanded on either side, so as to support two flat lateral flaps, which almost act as substitutes for wings, enabling the animal to take long flying leaps.

We cannot look at this great variety of effects, produced by slight modi-

fications of an uniform type, and so admirably adapting every creation for its place in nature,* without joining in the feeling so well expressed by the poet, as quoted by Dr. Roget :—

> "In human works, though laboured on with pain,
> A thousand movements scarce one purpose gain.
> In God's one single can its end produce,
> Yet serves to second too some other use."—Pope.

We have thus considered the mechanism of the muscles, the prime movers, and the apparatus on which they act: we have next to consider the nervous system, the mysterious means which supply, if we may so speak, information and impulse to all those muscles which are destined, by motions ultimately dependant upon the perceptions and volition of the animal, to maintain its requisite relations with external nature. It is supposed indeed, that the contractions of the involuntary muscles, such as the heart, whose constant actions are essential to the continuance of life from moment to moment, and are carried on without our consciousness, are independant of nervous influence; but perhaps this point has not yet been fully proved, for the muscles employed in respiration clearly are subject to this power, and as you cannot injure the respiratory nerves without affecting the circulation, who shall determine whether this is merely a secondary or conjoint effect. The digestion of the stomach, and the effect of the organs of secretion, equally involuntary and essential functions, have been shewn to depend on nervous influence. (Very possibly, as has been suggested, by their conveying some power analogous to that which produces the chemical decompositions effected by galvanism.) But however this may be, it is evident that all the voluntary muscles act only in virtue of this nervous influence. If their nerves be intersected, they become paralysed. The nervous system, therefore, discharges a double office; first, the nerves of sensation convey the impressions produced by external objects to the common sensorium; then the nerves of motion transmit to the limbs the orders, as it were, to execute the proper motions, which the will, the high judicial power enthroned on that sensorium, has pronounced to be necessary.

* The order of birds presents the most beautiful examples of this admirable accommodation of all parts of the skeleton, to a subserviency to the general end; which here is flight through the air. As muscular forces, superior to any possessed by mammalia are here requisite to impart adequate vigour to the motions of the anterior or wing-bearing extremities, we here find the whole humero-sternal part so modified, as to afford the most ample attachment. Levity being equally necessary, the bones are throughout so constructed, as to combine a maximum of strength with a minimum of weight, being universally hollow frames, of which the parietes are in the most condensed state, and their cavities filled not with marrow but with air, conveyed through large air cells communicating with the trachæa. The whole form of the body is equally adapted for flight, and assuredly every sparrow manifests the universal care and admirable skill of its contriver.

In the lowest zoophytes, as we have no distinct vessels or muscles, we have no distinct system of nerves; here every thing partakes of a diffused system, without definite organs; we have diffused circulation, diffused contractility, and diffused nervous influence, if we may apply that term when distinct nerves there are none, and the only sense seems to be a diffused sense of touch. But we have only to advance to the tribes of infusorial animals, animals, with a few exceptions, invisible by the naked eye, in order to find a distinct though simple nervous system, composed of a certain number of filaments, supplying one or two of the principal organs, and concentrated in a common ganglion. Advancing further, to the very lowest orders of mollusca, we trace very distinct filaments, connected with longer knots or ganglions of nerves, each ganglion probably forming a distinct centre of nervous influence and sensation, and in truth a little brain.

In the bivalve mollusca, which have a distinct head, and organs at least of the sense of vision, there is a more developed cephalic ganglion, which may be regarded as a specific brain; and this is considerably enlarged in the cephalopoda, where we first observe organs for the additional sense of hearing.

In all the vertebrated animals, a long spinal nervous chord is safely conveyed in a protected channel hollowed in the back of the vertebræ. This consists of two sets of nervous filaments, the posterior sending off nerves, which are found to be essential to the sensibility of the parts they supply, while the nerves arising from the anterior filaments of the spinal chord, are found to be those on which the power of motion depends in the voluntary muscles. The cephalic ganglion here also becomes greatly enlarged, and formed into a regular brain, which in all the vertebrata presents the same component parts, though developed in very different proportions in the different orders. In all, an expansion of the anterior extremity of the spinal chord, (the medulla oblongata,) supports a central tubercle, the cerebellum, on which rest the two optic tubercles, above these the two cerebral hemispheres are developed, in front of which are the olfactory tubercles.

It is the increasing development of the cerebral hemispheres, which marks the progressive advancement of the orders. In fishes, these are among the most insignificant of the parts; in reptiles they become far more prominent; in birds they are again enlarged; and in the mammalia, and especially in man, they attain their maximum of size.

We have thus hastily traced the various functions necessary to maintain each individual endowed with vital powers in a state of being and well-being; and we have endeavoured to lay down a concise, but we trust comprehensive view of all the successive modifications of those functions, throughout the various orders of the animal kingdom. It remains to consider the general plan adopted to enable those individuals, destined themselves to a brief term of existence, yet to fulfil the first law of creative

power, to replenish nature by the production of a constant succession of like forms; and thus while the individuals perish, to preserve the species permanent.

Besides the specific and universally analogous mode of reproduction in vegetables, by seed "after their kind," and inanimals by the like provision of eggs; we have moreover in the vegetable kingdom, and also in some of the lowest members of the animal kingdom, which closely border upon the former, and are therefore termed zoophytes, (animal plants) two subordinate methods of multiplication; the first of these is in fact multiplication by division, and is called fissiparous reproduction; thus we propagate plants by cuttings, each detached slip ultimately becoming a complete plant, like that from which it was taken. In the lower members of the animal kingdom, the infusory animalcules, polypi, the planaria (a vermiform race, approaching in structure to the annelida, or annular worms,) in some species of the annelida, and in the star-fish tribe, if we cut up the animals into various segments, each segment will reproduce the wanting parts, and re-form itself into a complete animal. The questions of individuality and personal identity in those species, might puzzle the most acute metaphysician. In the crustacea, this power becomes restricted to the partial reproduction of single detached limbs; and in higher animals, to the occasional reproduction of bony matter and the like.

Another mode of reproduction is that of vegetables by buds; the bud, in fact, is a nascent individual, with all the original properties and structure of the parent stock, but destined in plants, unless artificially separated, to remain attached to that parent stock, which thus presents (as do many of the zoophytes) a composite being.* If artificially detached, it will of course, as in the former method of propagation by slips, give rise to a complete plant; and its development will be exactly similar, whether it grows in the ground, or is still united to the original stock whence it sprang. There is a close connection between this and the following method of propagation by seed, for a seed is in effect nothing but a bud intended to be detached, and necessarily to commence a course of separate existence, and therefore provided with a store of nutriment essential to its first development. But whereas, in the case of the seed, we are allowed to observe a previous process carried on in the fæcundating organs of the flower essential

* The subject of these composite animals is perhaps the branch of physiology which has as yet received the least sufficient elucidation. It is especially to be regretted that Dr. Roget, in his admirable Bridgewater Essay, has treated it so briefly, and entirely omitted all mention of the most extraordinary class of composite animals, which belong to an higher order than the Zoophytes, and closely approximate to the bivalve mollusca, (though devoid of shells) the composite Ascidiæ, the subject of a monograph by Savigny, assuredly one of the most valuable of Zoological Essays. We hope in a future number to return to this subject, and to have some original information to produce in its illustration.

(though we know not how) to its production; in the case of the bud, we cannot detect any such preparatory process: the original steps are in both cases inexplicable to our reason, and in the latter invisible to our senses. Multiplication by buds is called gemmiferous reproduction. In the animal kingdom we seem to have an analogous example in the hydra, or fresh water polypi; in this case, however, the young individual which at first issues as a bud from the side of the parent trunk, at length detaches itself, and carries on a separate existence. In many lower animals, such as the sea anemone or actinia, such germs, then called gemmules, develope themselves in the interior of the parent, and are ultimately thence projected. This case differs from oviparous reproduction only in the circumstance, that we are unable to detect any previous egg; but this is only an acknowledgment of our ignorance of the first steps of all gemmiferous reproduction, which may nevertheless very closely approximate to the more regular and specific mode of re-production, whereby, as every plant springs from a seed, every animal springs originally *ab ovo*, from an egg; for this is the universal law; the deviation of viviparous re-production being only apparent: for here also anatomy makes us acquainted with the original egg, although its mode of development is altogether different; since the viviparous germ requires for its growth not only the scanty supply of nutriment provided in the original egg, (for every seed or egg consists of a germ, attached to such an alimentary system,) but in viviparous reproduction the egg being extremely minute, the young require in their first state additional supplies of nutriment, and this they obtain by temporary organs of incorporation with the parent substance, by which they participate in the distribution of its nutritive fluid, the blood.

Wherever we observe distinct seeds or eggs, we observe also a double system essential to their production; the one may be called the proliferous system, in which the seed or eggs are originally formed, but still destitute of the vital power of developing the included germs; the other, the fecundating system, essential in some inscrutable manner to the communication of that vivifying power. In vegetables, these organs are included in the pistil and stamina of the flowers; in some instances, both systems are included in the same flower, these are called monœcious; in others, the proliferous system and the fecundating system occupy the flowers of distinct individual trees of the same species, these are called diœcious. We have the same distinctions in the animal kingdom. In many of the Zoophytes, as we have seen, we have only an obscure gemmiferous reproduction; but in the bivalve mollusca, we have regular monœcious oviparous reproduction. Here the egg appears simply to pass from its first receptacle, through channels in the same individual supplying the fecundating system. The same process continues in two orders of the univalves, the cyclobranchia, or limpet family, and the scuti-branchia, or venus-ear family. In other univalves of the terrestrial family of snails, and of the aquatic families of the

trochus and turbo, we find a sort of middle term between the monœcious and diœcious plans; for here each individual possesses, like the monœcia, both the proliferous and fecundating systems. But like the diœcia, the combined influences of two individuals are required, each reciprocally fecundating the other, and each becoming in turn proliferous. In the univalves of the buccinoidal family, (Buccinum murex, &c.) as in all the superior orders, insects, crustacea, fishes, reptiles, birds, and mammalia, the plan pursued is strictly diœcious;* the only differences being, that in some instances, (fish and reptiles) the eggs are fecundated after their exclusion from the parent body, and in others, (insects, birds, and mammalia) before.

Having thus traced the whole series of the animal functions, as exhibited in their mature state, it would be most interesting to give some account of the light thrown by the most recent observations on the progress of their original development in the germ included in the egg. The effects of incubation in the egg of the domestic fowl, as they are the most easily observed, so are they among the most beautiful illustrations of the prospective contrivances of that providential care which gradually fashions, ere yet the use of any one of them is possible, organs accommodated with the most exact view to all the wants of a future state of existence, totally dissimilar to that which then prevails.—"Whose eyes did see their substance being yet imperfect; in whose book were all their members written, which gradually and successively were fashioned, while as yet there was none of them."

But this must be reserved for a future Essay. We shall propose also, in the ensuing numbers, to follow up this general introduction, by a brief account of the most important of the great divisions of the animal kingdom, illustrated by a constant reference to the preparations contained in the museum of the Bristol Institution, which will be found very copious. We shall hope thus materially to add to the instructive usefulness of that excellent institution, to develope all its resources as a rich local source of supplying the most efficient means of physiological information, and to extend the general interest in its adequate support and increase.

* We have dwelt more particularly on the single order of bivalves and univalves, because in this class we have illustrations of all the known combinations as to this subject; and it is important to observe the very wide deviations of animals in this most important function, exhibiting so close an agreement in the rest of their organization.

(To be continued.)

ON THE FORMATION AND GROWTH OF CORAL REEFS AND ISLANDS.

BY S. STUTCHBURY.

Being a Paper read before the Philosophical and Literary Society of Bristol, March, 1832.

In attempting to embody in a popular form, the following brief outline of the history of coral reefs and islands, it will be necessary to premise the subject by stating, that the greater portion of the matter will be found to assimilate very closely to that of various published authorities, but corroborated by personal observations made among the Islands of the South Pacific, particularly those denoted on the charts by the name of the Dangerous Archipelago, and situated between the latitudes 12 and 27 degrees south, longitude 130 and 155 west, forming a part of that division of the world entitled Eastern Oceanica, or Polynesia.

The particular groupe of islands to which we shall call attention, is named by the natives *Paumotus*, literally signifying low islands, *Pau* in the Tahitian language meaning low, and *Motu* an island.

In speaking of the material of coral, to which it will be necessary continually to allude, we mean that hard cretaceous substance, formed by myriads of minute marine animals, called saxigenous (or rock making) polypiers, of which there exist an amazing variety.

Note.—Our motive in appending the following abstracts from the published account of the voyage of Captain Flinders, in the form of a note, is, that although it has already been often quoted, and although we differ from it in very many particulars, yet we still think it highly deserving of being perpetuated and brought forward, as a beautiful and popular view of these highly interesting formations.

Captain Flinders, when upon the coast of New Holland, made the following observations on the formation of coral islands; speaking of those in Torres straits, he says, "These islands, or banks, are in different stages of progress; some have become islands, but not yet habitable; some are above high water mark, but destitute of vegetation; whilst others are overflowed with every returning tide." He goes on to say:—

"It seems to me, that when the animalcules which form the corals at the bottom of the ocean, cease to live, their structures adhere to each other, by virtue either of the glutinous remains within, or of some property in salt water; and the interstices being gradually filled up with sand and broken pieces of coral washed by the sea, which also adhere, a mass of rock is formed. Future races of these animals erect their habitations upon the rising bank, and die in their turn to increase, but principally to elevate, this monument of their wonderful labours. The care taken to work perpendicularly in their early stages, would mark a surprising instinct in these diminutive creatures. Their wall of coral, for the most part in situations where the winds are constant, being arrived at their surface, affords a shelter, to leeward of which their infant colonies may be safely sent forth; and to their instinctive foresight it seems to be owing, that the windward side of a reef, exposed to the open sea, is generally, if not always, the highest part, and rises almost perpendicular, sometimes from the depth of two hundred and perhaps more fathoms. To be constantly covered

The corals principally instrumental in the formation of reefs, belong to Lamarck's third order of polypes, the polypi vaginati, and the fifth division, which he distinguishes as his polypiers lamellifères, containing the following recent genera:—caryophillia, fungia, pavonia, agaricia, meandrina, monticularia, echinopora, explanaria, astrea, porites, pocillopora, madrepora, seriatopora, and oculina; in fact, the whole of the Linnean genus madrepora. Of these, caryophillia, meandrina, astrea, porites, and madrepora, form the main portion of the reef; while the ornamental parts are made up by a diffusion of the other genera, together with gorgonia, isis, corallium, melitea, corallina, spongia, alcyonium, actinia, &c. &c. independent of the locomotive beauties, in the form of astrea, echini, and testacea.

For conciseness, it will be well to divide and treat of these islands, under the different forms that they assume, which are as follows, *first*, the circular; *secondly*, the flat; *thirdly*, the long narrow; and *fourthly*, those which encircle high lands.

The whole of the islands, exceeding fifty in number, which (with two or three exceptions) form the groupe called the Paumotus, are of the first kind, and consist of narrow strips or belts of coral, of an annulate or circular form, each containing or enclosing a lagoon. These strips of coral have never been observed to exceed one mile, but are much more generally of about four or five hundred yards in width; seldom raised above the water more than four or five feet, and presenting an abrupt line towards the ocean. On these the waves break with much violence, and at a short distance from them the depth is usually so great, as to be denoted by navigators as unfathomable; this however is a vague mode of expressing themselves, as it is now known that soundings may be had at more than one thousand fathoms; and we have repeatedly obtained soundings about a mile from the shore, at between two and three hundred, (mariners in ordinary cases seldom using a line of more than one hundred and twenty fathoms deep, which is by them termed the deep sea line; and in fact it requires great care, time, and labour, to get soundings at much greater depths;) while the interior of the lagoon is comparatively shallow, varying from an inclined beach to a depth of one hundred fathoms or more.

These islands vary from two and three miles in circumference to one hundred or one hundred and fifty; and in many instances a fissure, or

with salt water seems necessary to the existence of the animalcules, for they do not work, except in holes upon the reef, beyond low water mark; but the coral sand and other broken remnants, being rarely covered, their adhesive property, and remaining in a loose state, form what is usually called a key, upon the top of a reef.

The new bank is not long in being visited by sea birds; salt plants take root upon it, and a soil begins to be formed; a cocoa nut, or the drupe of a pandanus is thrown ashore; land birds visit, and deposit seeds of shrubs and trees; every high tide, and still more every gale, adds something to the bank; the form of an island is gradually assumed; and last of all comes man to take possession."

break, in the ring of coral occurs, forming an entrance into the lagoon, and thus enabling ships to enter, in which cases they form commodious and safe harbours.

The reefs and banks of coral not yet above the level of the water, are exceedingly numerous; we have seen lists of more than a hundred, not to be found in any published chart; these lists are handed on from one captain to another, whose business carries them to the seas of the Pacific.

The height above the level of the ocean seldom exceeding four or five feet, it often happens that the sea breaks over with great violence at the windward side of the island.

It is not unusual to see, during a strong easterly wind, the waves of the ocean forced against the abrupt barrier of coral; where the surf, towering in one vast sheet of water to an immense height, would fall within the lagoon in form of a shower, exhibiting all the iris colours of the rainbow; and thus, by the continued overflow at the windward side, and by the rush of water upon the ebb tide, through the leeward opening, in this way preventing the growth of the corals, is the entrance kept open. But there can be little doubt, that in a series of years the increase on the weather side, will form a perfect breakwater; and then, from the quiescent state of the water within the lagoon, the leeward opening will be choked by the growth of coral, and the fresh supply of water by the flood tides cut off. Evaporation going on, salt would be deposited, the zoophytes of the lagoon would lose their vitality; and at this period a perfectly new order of things would commence, the subsequent formations being deposited horizontally and filling up the vast basin which would then bear some slight analogy to the coal basins of this district, or the more recent basins of London and Paris.

That many of these islands have actually arrived at this state, is known to navigators; in these the lagoon is perfect, the ring of reef having no visible opening; the water, which is accumulated within the lagoon by the spray dashing over the windward edge, finds the level of the surrounding ocean, by percolation through the sides of the basin.

Confining the assertion to the corals before mentioned, because we are aware, that a few genera of Lamarck's second and fourth orders have been found to inhabit great depths, we believe it will not be found that corals commence their growth or origin, at a greater depth than fifteen or twenty fathoms. Quoy and Gaimard, who accompanied Capt. Freycinet, say indeed twenty or thirty feet.

This assertion is in opposition to a statement of Lamoroux's, a naturalist, whose name stands most deservedly pre-eminent, from the value of his investigations with regard to the particular subject before us.

He says, in a prefatory address appended to his Corallina, speaking of the madreporous islands of the southern pacific: "Their base is fixed on the

foundation of the sea, at a depth that cannot be measured, whilst their extremities are lost in the regions of the clouds."*

In proof of the views we are adverting to, with regard to the depth at which they actually commence their growth, we have only to mention that it is in some degree corroborated by the following facts:—Within the lagoons, upon a calm clear day, the smallest objects may be seen at a depth of one hundred feet or more;† and at these times, the bottom may be observed strewed with dead shells and broken fragments of coral; whereas, if the animals could exist at such depths, the centre of the lagoons would be seen paved with these productions, and exhibiting, even in a more beautiful form, the living analogues of the surrounding reefs; yet here and there, in somewhat shallower depths, we find a solitary specimen, which by accident has been broken off from the reefs above, growing and extending itself upwards, like a plant partially deprived of light and air.

In this manner many of the differences, which are supposed to distinguish species, may be explained; thus, if we suppose a flattened wide-spreading fragment of madrepora prolifera, to be broken off from the upper part of the reef, this fragment, if its vitality was not destroyed by its descending into too great a depth, would then commence a lengthened growth, with its branches ramifying like stags' horns, and forming the species called cervicornis.

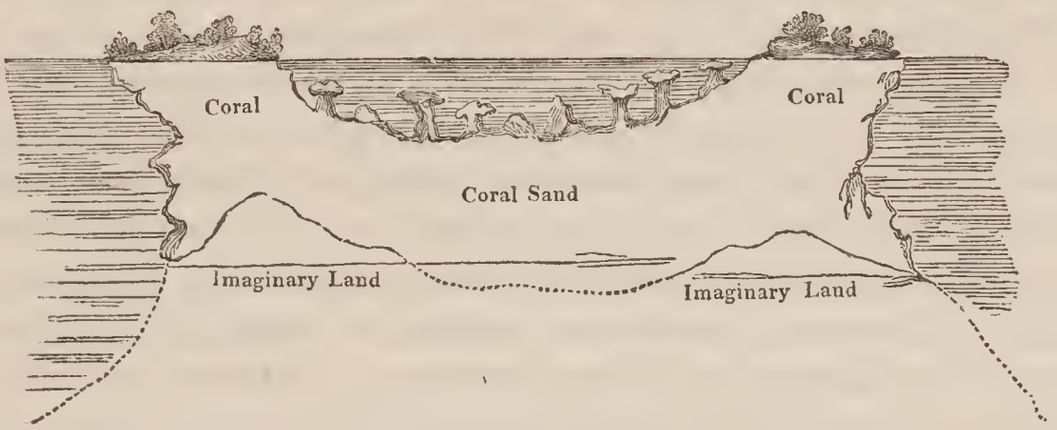
We ought to mention that the lagoons are studded with smaller reefs in all the various stages of their growth; and in these we have the best evidence of the depths at which the polypiers commence their work, as in most cases their nucleus, or rather the foundation of their structure, is a portion of the surrounding reef dismembered from its original situation, and washed into deeper water; upon this the polypes build their habitations, each appearing to act independently in the creation of its own cell; while the whole seem actuated by a common instinctive principle, which induces them to extend the colony upwards towards the surface of the water, in the form of sugar loaves; when the apex of the cone has reached to within a few inches of the low-water level, the innate principle before mentioned directs their operations laterally, when, after a time, they assume the form of a mushroom upon its pedicle.

These clumps do not arise from a greater depth than sixteen or seven-

* Lamoroux's views were probably derived from the accounts given by various voyagers; Flinders, for instance, who speaks of their being based at a depth of two hundred fathoms or more. This idea must have arisen from the observer having sounded and obtained those depths, along-side coral formations, and not taking into consideration the fact of the coral being formed upon the summits of sub-marine hills.

† In rough weather, the bottom may be observed exceeding well, by looking through a tube, with one end inserted just beneath the surface, or by dropping a small quantity of oil on the water.

teen fathoms, while in deeper water, the broken masses of rock may be seen without any living portion attached; and the mass, like the smaller conical clumps, remains loose among the sand, being frequently overturned by the straining of the ships cables, which, during calm weather, had got entangled among them.



When two or three of these smaller reefs approximate by their lateral increase, they would unite together at their circumference, light would be shut out, the animals would cease to exist in the dark interior, and thus chambers or caves would be formed.

We perhaps may be allowed to digress a little from our subject, in endeavouring to depict the beauty, the exquisite beauty of these living submarine gardens. Those who have had the pleasure of visiting these scenes, will never forget the delight they must have experienced on a calm day, when the meridian sun directed his powerful rays into the recesses of these natural grottoes.

In imagining the similarity to a garden, it is not difficult to picture the various coloured actinias as beautiful anemonies; the muricated branching madrepores, as shrubs; with a delicacy of tinting, unequalled by terrestrial plants, the caryophilliæ and agariciæ would not unaptly suggest the familiar idea of cauliflowers, endive, and lettuces; and among them, to make the resemblance more complete, there are not wanting crabs for spiders, variously coloured eels for snakes, nor even snails, slugs, and dew worms, all of which would readily find their representatives upon the land, but to attempt to paint or give the slightest conception of such a scene, would require the pen of a poet, rather than the simple matter of fact natural historian.

Comparatively with other accreting formations, the growth of coral may be esteemed as rapid and estimable within the period of man's life.

At the island called Taapoto, there may be seen in smooth weather, a ship's anchor lying in about seven fathoms water, now entirely encrusted by coral, but still preserving its original form; this anchor belonged to a large ship, which was wrecked upon the island during the childhood of some of the natives now living, and the probability is that the time does not exceed half a century. Shells, or any extraneous substances, are

often encrusted by coral. In various collections, are examples of bottles, upon which very dense corals have colonised themselves; and there is in the museum of the Bristol Institution, a bottle which was picked up by a diver in Port Royal, Jamaica, to which a dense species of astrea, weighing 1*lb.* 8*oz.* is adherent. Another specimen of agaricia, weighing 2*lb.* 9*oz.* surrounds a species of oyster, whose age could not be more than two years, and yet it is completely enveloped by this dense coral. And in further proof of the rapidity with which these animals secrete the calcareous matter, we have only to refer to a paper in the Philosophical Transactions, by Capt. Lloyd, who was engaged by Bolivar to ascertain the relative levels of the Pacific and Atlantic oceans, and to complete a survey of the intervening isthmus of Darien; wherein he points out the possibility of forming a breakwater across the mouth of Navy Bay, by throwing in coral broken from the adjacent reefs: his attention was called to this by having collected specimens as curiosities, and not being able to carry them away at the time, he returned a short period after, and to his surprise found them permanently soldered to the place whereon he had placed them by their own calcareous deposit.

We at the same time caution projectors of this kind to take into their mature consideration, whether the foundation might not, by this means, be laid for entirely filling up the harbour, and thus depriving the navy of a port, which it had only intended to make more secure. In fact, the natives of the Polynesian isles have long employed this method for building their jettys, piers, wharfs, fish preserves, &c. At the island of Barabora, a very beautiful pier has thus been formed by the natives, along-side of which a large vessel may lie and discharge, or take in cargo. For a view of this, and much interesting matter respecting these islands, the reader may consult Bennet and Tyerman's Mission to the South Sea Islands.

In a similar manner are vast quantities of shells, &c., encased, fixed, and preserved, either by the hardening of sand, secretion of the calcareous matter before mentioned, or as follows.

It would appear, that as during the formation of a reef, portions of it become compact, and as dense as any limestone rock; the presumption arises, that when the coral animals die, the animal matter decomposes, and the carbonate of lime, of which the coral is composed, will be held in solution, and again, (probably under peculiar circumstances) precipitated of the consistence of paste, entombing shells, corals, fish, &c., which have sufficient animal matter to protect them, by which means they retain their organic form; in this manner closely resembling the limestones, in which the fossil remains of corals, shells, &c., are so often found; and, as we believe, cemented by a paste composed of the lime derived from their congeners.

Among these islands it is not uncommon to see extensive beds, or strata, of particular species of shells, deposited along the shores in the

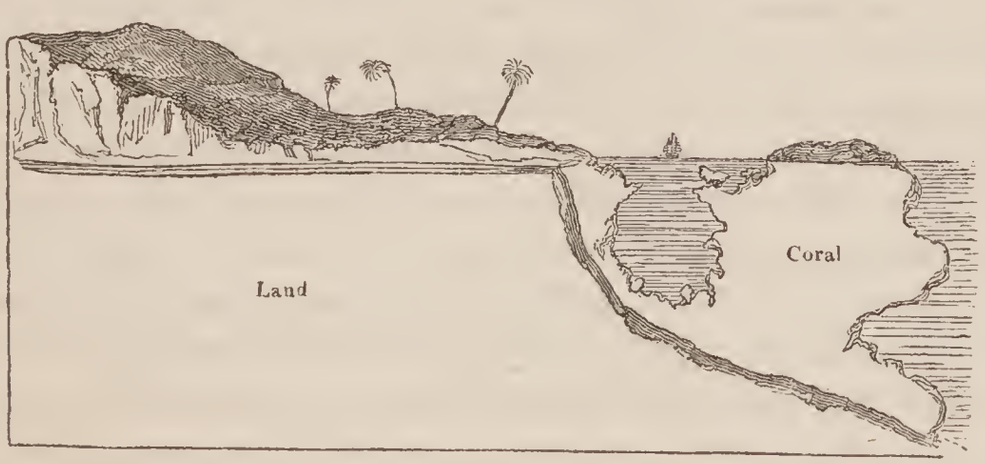
most regular order, with comparatively little or no admixture of other substances, which may be accounted for by considering their separation to have taken place by the mechanical action of the waves, according to their different degrees of gravity.*

Islands often occur of a flat or tabular form, generally oval or irregularly circular at their circumference: of this form may be mentioned the groupe, named by Cook the Friendly Isles, consisting of numerous islands, the majority of which are of the tabular form.

There are also many crescent shaped reefs, with the most convex portion of their arc the highest, often denoting themselves to the mariner only by the breaking of the waves, and here and there a rock above the level of the ocean, while the horns of the crescent are depressed, and gradually lost in the greater depths; in a few instances, as at the groupe called Gambier's Islands, they are sufficiently raised to have become verdant and inhabited.

We may next refer to those which form long narrow slips of land; for example, Tethuroa,† or the great reef which takes the course of the north-eastern shore of New Holland, which Captain Flinders describes as being more than one thousand miles in extent; in the course of which, there is a continued portion, exceeding three hundred and fifty miles, with scarcely a break or passage through it.

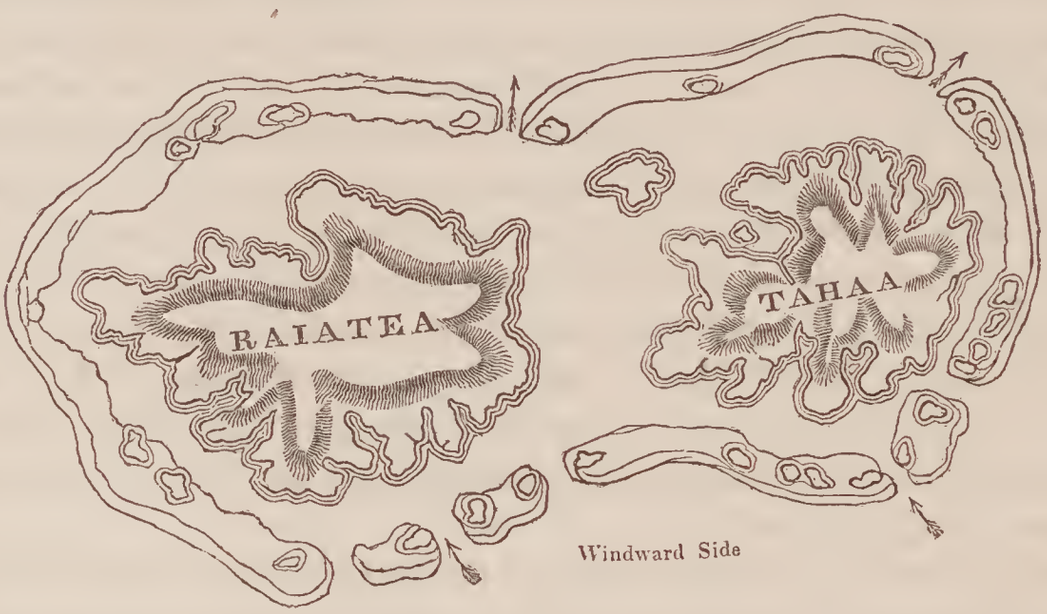
Among these groupes are many high mountainous mineral-formed islands, which are surrounded by coral; of these it will only be necessary to refer to the Society Isles, which include Tahiti, and other islands familiar to us, from the beautiful descriptions we have been favoured with, by our intrepid circumnavigators, Wallis, Cook, and others, Of these islands, at the present, we need only state, that they are surrounded by coral reefs, generally situate four or five hundred yards off shore, with a deep channel between, having numerous openings, through which ships can enter, and lie at anchor in perfect safety. These breaks in the coral barrier, are in most instances opposite the mouths of fresh water rivulets.



* At Bow Island may be observed beds of cardium fragum, from six to eight feet thick, and more than two miles in extent, without even the broken portion of any other shells being deposited in the same stratum.

† Tethuroa is a coral island, situate a few leagues from Tahiti, and uninhabited,

The islands Raiatea and Tahaa, *Ullietea* and *Otaha* of Cook, are divided by a strait, by which ships can enter at the windward side of the island, and get to sea again through the leeward channels. These two islands are entirely surrounded by one coral reef, extending throughout the circumference of both; the openings through the reef are in most cases denoted by the points being rather higher and often verdant, having trees, principally cocoa nut trees, planted by the natives upon them. The passage is seldom more than a hundred yards in breadth, with the depth varying from three to fifteen fathoms.



The form of all coral islands must very materially depend upon that of the base on which they happen to be built, therefore we must assume a form of substructure corresponding with the peculiarity of the formation we are investigating. We have thus enumerated several formations differing essentially from each other.

Although, in common with all animated creatures, the polypes possess certain instinctive powers, yet so constant are their results, that under whatever circumstances they may be placed, their actions and mode of growth are the same; therefore it is evident, that the form of the reefs produced are not so much dependant upon the architectural design of the builders, as upon the form of the basis they may have to build upon.

Let us for a moment imagine the water to have left that portion of the ocean in which these islands abound, and what might we presume would be their appearance? should we not have mountains of various degrees of elevation? And is it not as likely that the majority of these mountains should be of volcanic origin, as that the present country of Auvergne, Italy, or Mexico, should exhibit evidences of volcanic action long since

except at particular seasons, when it is visited by the Tahitian nobility and invalids, as a place of recreation and fashion, similar to our watering places; and it is here that the ladies sojourn during the fattening season, just previous to their national annual meetings; for in this part of the world, height and weight are essential to enable them to carry off the palm of beauty.

expired?—so long since, that we have no historical record of their existence, and yet we have ample ocular proof of such having been the case, strengthened by the fact of a few remaining in actual operation. Also taking into consideration the positive evidence of the greater portion of our present dry land having been submerged, and whether at that time Europe must not have been similarly situated with that portion of the Pacific to which we have now been directing your attention. Comparing the Apeninnes or Jura chain of mountains, or if you please, the colossal Andes, with the coral chain or reef of New Holland, the western isles of Scotland, with the islands of Tahiti, &c.; the extinct volcanoes of Auvergne, with the circular coral lagoon isles of the Paumotus; and there can be little doubt that the analogy of circumstances will appear much closer than it is necessary now to insist upon. As a further proof that the lagoon islands are formed upon the edges of extinct volcanic craters, Captain Beechey found lava or pumice within one of the lagoons, among the Gambier isles; and that the islands are being repeatedly raised or sunken by submarine movements, is evidenced in many instances; it will be sufficient to show that land is raised; proof of its depression would from the very circumstance of its being submerged, be more difficult, except from analogy or actual observation; still proofs of the latter are not wanting; for one, take the following case, which was the topic of conversation among the islanders, when the author of this memoir was among them, in 1826.

Towards the close of the year 1825, the island of Ana, or Chain Island, was devastated by a violent *toerou*, or westerly wind, which lasted many hours; and coming from an unusual quarter, the sea broke with infuriated violence on the western portion of the reef, carrying with it trees, huts, and natives; a few only who were fortunate enough to secure their canoes, being saved, by their being drifted across the lagoon to the opposite shore. In this instance it was evident, even to the natives, that the hurricane alone was not sufficient to account for the violent agitation of the ocean. When the sea had returned to a smooth state, it was found that a great portion of the western side of the island had disappeared, and it was computed that not less than three hundred lives were lost upon the occasion, and great numbers of individuals were obliged to emigrate to the neighbouring isles.

Whether and how these islands are raised after their formation, is a question which requires deliberate investigation, on account of the slight degree of height at which the majority of them stand above the level of the ocean. Our opinion is, that a gradual upraising has in some way or other taken place, and that they do not owe their present height to the accidental increase upon their surface, by the debris of the outer portion of the reef being washed up.

With regard to the flat, tabular islands, they may have been formed either upon the tops of sub-marine mountains, or by the filling up of the

before mentioned lagoons. Tongataboo, Vavaa, and others of the Tonga and Hapai isles, are standing from ten to thirty feet above the surface of the water.

The crescent-shaped reefs appear to have been formed under similar circumstances to the lagoons; but at the time of their elevation, their projectile force was unequally exerted, thus depressing one portion of the circle, while the other was in a slight degree elevated.

Of the long slips of coral, or coral banks, such as Tethuroa, and the great barrier of New Holland, the most probable solution will be, to consider them as built upon elevated ridges, or the tops of a vast chain of mountains, the corals having formed upon the apices, until arrived at the water's surface, when they enlarged themselves laterally, until one continued wall of coral presented itself, with occasional openings, which may have happened by the chain of mountains being broken by champaign country. Captain King states, that the continuity of the great barrier, taking seven hundred and fifty miles of its course, is broken by the intervention of gaps, at about thirty or forty miles distance from each other; this would answer very well for the distance from one cone to the other of any chain of mountains, supposing them to be submerged.

Lastly, we arrive at the high basaltic islands, the Society Isles, for instance, of which we will take Tahiti. The highest point of this island is computed to be 12,000 feet above the level of the ocean; the whole of the island is formed of basalt, with scarcely any other substance, except the common minerals which occur in such rocks, some portions being very compact, and of which the natives form their tools, while other parts are vesicular, or scoriated, bearing decided evidences of volcanic origin.

Here a reef surrounds the shores, sometimes forming a connected flat coral platform; but in most instances it appears to have raised itself abruptly from the sides of the land, leaving a space, as we have before stated, between the reef and the shore.

This island may be considered as a favourable example for explaining, or rather corroborating, the views before taken; for upon the apex of one of the highest mountains, there is a distinct and regular stratum of semi-fossil coral; while at the summit of an adjacent mountain, at a much lower elevation, there is a basin considered by most who have visited it to be an extinct volcanic crater, now filled with rain water and forming a fresh water lake: this basin or crater has its outer edge broken by two notches or gorges.*

We are thus furnished with the best possible proof of the state in which this and the other high lands of the group once stood; it has been stated

* The lake is named by the natives Vai-hiria, from *vai*, water, and *hiria*, to swim, in consequence of the only mode of getting from the one side to the other being by swimming across by the two gorges; the edges of the basin being in other parts exceedingly perpendicnlar. Its diameter in the rainy season is about one mile.

that it is twelve thousand feet high, and that on the top of its highest mountain there is coral, while at a short distance there is a volcanic crater with two gorges. Now imagine this island to have been wholly submerged, is it not apparent that the most elevated point was within reach of the coral animals, to found their colonies upon?—whilst the crater at the same elevation would have formed the basis for a lagoon island, with two openings; when, from its being so much below the surface, it remained uncoated by coral matter; but, being elevated together with the adjacent isles, and filling with rain water, it now forms the fresh water lake.

Therefore it is a natural presumption, that the island was projected twelve thousand feet at one movement: (for had it been gradual, the whole island would have been flanked by limestone, or if its uprising had been intermittent, the limestone would present itself in the form of zones or terraces;) and, in consequence of the time which has elapsed since this took place, the coral animals have had time to form the vast bulk of calcareous matter, which now surrounds these islands: and should any after elevations take place, sufficient to raise the whole of this portion of Polynesia a few thousand feet, it will be equally evident that a continent in regard to extent of country as large as Europe will be produced, and in many respects bearing a strong analogy to it.

Tahiti is not singular with regard to these proofs of comparatively modern elevations; if further examples were necessary, it would be only to mention as familiar instances, the Isle of France, where a bed of coral ten feet thick may be observed between two beds of lava; Bermuda, Guadaloupe, Barbadoes, and other islands, independent of the proofs which the continent of Europe gives us of similar occurrences in antecedent times; for how else is it that our own island presents such numerous facts relative to its having once formed the bottom of the ocean? Again, how can we account for the marine productions which are situated upon the Pyrenees, at the height of 10,500 feet; or in America, upon the Andes, at 13,000?

Italy offers a peculiarly favourable spot to be put in opposition to the formations here treated of. Italy in general is covered by strata containing marine remains, extending to an altitude of 1200 feet above the sea level, while the extreme height of the Appenines is 9000 feet; the whole of the chain from this height down to that of 1200, must be supposed to have formed a ridge rising above the sea.

It is therefore evident, that at the period at which Italy became dry land, the whole must have experienced an elevation of 1200 feet; and that the cementing paste was precipitated suddenly, is proved by the perfection and peculiar situation in which many of the marine fossils are found; among such may be mentioned a specimen from Monte Bolca, now in the collection at Paris, wherein one fish appears to have been arrested in the act of swallowing another.

So closely do some naturalists draw these analogies, that the Abbé Fortis, in the Journ. de Physique for 1786, says that he has identified some of the fossil fishes from the above locality, with living specimens from Otaheitè. Certain it is, that the identification of genera has been made out in several instances of late years, by the discovery of recent animals in the southern pacific, whose analogues were before only known in a fossil state. Nor are we without direct evidence of such forces now actually operating; numerous instances might be quoted, such as the appearance of several islands in the Grecian Archipelago, recorded by Pliny as occurring in his own time, particularly in the bay of Santorin; since which, others have occurred among the Azores, where, in 1638, a submarine volcano arose close to the island of St. Michael, occupying a space of nine miles in length, by three in breadth, and remained above the water three weeks, when it disappeared. In November, 1720, it again appeared, and remained until November, 1723, when it sunk and gave eighty fathoms soundings; and it will be recollected, that in 1811, it once more shewed itself, was taken possession of by the British, and received the name Sabrina, thus giving a periodic distance of time, of about ninety years, though probably this ought only to be noticed as a remarkable coincidence; and lately, we have had the evidence of Graham's Island. It in fact is only necessary to read the various geological works, to satisfy the reader, of the very numerous cases of alteration which have taken place on the face of the earth, by volcanic agency and earthquakes.

That the New Zealanders have a knowledge of such events as the rising of land from the depths of the ocean, is certified by their having a deity, who makes land under the waters when he fastens a hook to it, which it is another god's duty to haul up: *Mowheemoha* is the name of the god who makes the land; *Mowheebotakee*, of the god who hauls it up, and is the giver of life.

NOTICE
OF
PROFESSOR FARADAY'S RECENT DISCOVERIES,
With regard to the Laws of Electro-Chemical Decomposition.

At the period when the first number of this Journal is about to make its appearance, the most important novelty in chemical science appears to be undoubtedly the recent discoveries in Electro-Chemistry, by the individual to whom both the important branches of physics which have given rise to this compound appellation, have been previously so much indebted. Mr. Faraday has now investigated the general laws of electro-chemical decomposition; he has reduced those with which we were before acquainted, to a degree of precision far beyond that attained by former discoveries, and he has suggested many which are perfectly new—and one of them of transcendant importance—namely, that electro-chemical action follows the law of definite proportions; so that if we take the quantity of water

decomposed by a given quantity of galvanic power as our standard, we shall find, if we proceed to operate on the chlorides of lead, tin, and silver, that the quantities of each of those metals evolved, are always in definite proportions; and these proportions will closely agree with those deduced from the chemical theory of definite proportions; so that the numbers which express the chemical equivalents of water, lead, tin, &c. will equally express their electrical equivalents.

Mr. Faraday has also removed a very material source of error, which previously rendered very obscure the results of electro-chemical analysis, by first teaching us accurately to discriminate between the primary results of that decomposition, and the secondary results which may arise from the substances thus primarily evolved, entering at the very moment into new combinations with other materials in the solution subjected to the galvanic influence, and thus effecting farther and very different secondary decompositions. For instance, in any solution containing water, the water will be primarily decomposed into oxygen and hydrogen; and these nascent gases may effect further decompositions in the other materials, which might often be erroneously ascribed to the direct influence of electricity.

We greatly regret that the narrowness of our space, and the pressure of materials, must prevent our doing more in this number than giving a brief explanation of the new nomenclature under which Mr. Faraday has announced his discoveries, and the most concise annunciation of his general laws; but we hope to return to this subject in our next, when also we shall propose, as introductory to this branch of scientific enquiry, to give a popular but precise view of the general laws of the philosophy of electro-magnetism, or the doctrine of polar forces, the branch of physics which at the present moment appears pregnant with the most important discoveries, as to the general constitution of nature. Our readers who may have looked into Prout's Bridgewater Treatise, will especially feel the justice of our anticipations.

In explaining Mr. Faraday's nomenclature, we must first observe, that his terms are derived from the idea of an electrical current, from the positive to the negative poles of the electromotive apparatus;* but still they

* In this account of the direction of the electrical current, it must be observed, that we speak of the current set in motion as proceeding externally along the conductor employed to compleat the circuit, and as the phænomena materially depend on the completion of the circuit, this conductor, the fil conjonctif of Ampere, requires a distinct technical name; we would propose syzygy, a term already familiar in astronomy. Now it is evident that the direction of this external current returning along the syzygy, will be the reverse of that which proceeds internally, or along the acid interposed between the plates in each galvanic combination; for internally the current must be towards the pole from which it issues externally; or, to use Faraday's expressions, the anode and exode of the syzygy, and that of the electromotor must be inverted. Obviously as this arises from the idea of a current proceeding along the opposite sides of a continuous circuit, it has often been neglected, with great confusion both of thought and language.

must not be understood as involving any adhesion to the theory of a single fluid, but merely as affording a convenient conventional formula, which will be equally applicable, although we consider these opposite polar forces as two distinct *powers,* (fluid is a purely hypothetical term,) which latter view is assuredly the conclusion of those who have applied to the subject the highest resources of mathematical analysis. Still, however, these polar powers, as they neutralise each other, may be very conveniently expressed by the terms positive and negative; and though two currents, or progressions in opposite directions, of either polar force towards the pole where it is manifested externally, must be implied on this hypothesis; still we may most conveniently confine our attention to one only of these currents, since to embrace both would merely double the correlative terms of our formulæ, and necessarily lead to the same results.

Mr. F. names the conducting wires attached to the poles of the electromotive apparatus, *electrodes*—paths of electricity. M. Ampere had before proposed to call them rheophores, conductors of currents.

If any body be made to conduct an electrical current, he calls the extremity of such body by which the current enters, the *anode,* (the way up,) and that by which it issues, the *cathode,* (the way down.)

By introducing into these terms the ideas of ascent and descent, Mr. F. has very conveniently employed expressions which necessarily suggest the great primary principle of electro-magnetism, namely, that a magnet is equivalent to the axis of a circular electric current, the north pole being on the left hand, and the south pole on the right hand of the direction of the electric current. But we must remember, that the north and south poles, as they are called, of a magnetic compass needle, are in truth opposite to those of the great terrestrial magnet which attract them; therefore the north *terrestrial* pole (equivalent to the south pole of a magnetised needle) must be dextral, and the south terrestrial pole sinistral, with reference to such a current. But if we suppose an electrical current established round the earth, and proceeding from east to west, in the direction of the apparent course of the sun, (which is believed with much probability to cause such a current) the north and south terrestrial poles would necessarily be placed as they are placed, from the mere influence of that current. Mr. F. has therefore employed the terms anode and catode, ascent and descent, as suggesting the analogy of the great terrestrial electric current, from the rising to the setting sun.

Mr. F. uses the verb to electrolyze, for, to decompose a body by electricity; and the noun electrolyte, for a body capable of undergoing such decomposition. He denominates the constituents evolved by such decomposition, according as they are evolved at the opposite extremities of the electrolyte, with reference to the direction of the electric current, anions, (going upwards,) if evolved at the anode; and cations, (going downwards,) if evolved at the catode.

Thus it has long been known that acids are generally determined to the

positive conductor of an electro-motive apparatus, and bases to the negative conductor; therefore (in accordance with the views of Sir H. Davy, that chemical and electrical attractions are really only modifications of the same principle,) acids have been considered as electro-negative, and their bases as electro-positive, and therefore attracted by their opposite poles. Mr. F. however, prefers simply calling the acids in these cases anions, and the bases cations, which merely expresses the fact, without implying any hypothesis; he calls both constituents by the general name of ions.

The principal laws which Mr. Faraday has established are these:—

1. The decomposition of a body necessarily depends on its conducting power, and this often varies in different states of the same body; thus there is a class of bodies which, when solid, insulate electricity, (especially under the low intensities induced by galvanic action) but when rendered fluid, conduct it freely, and are decomposed by it; thus ice is a non-conducting non-electrolyte, water a conducting electrolyte; and the same differences are found in the solid and fluid states of potassa, protoxide of lead, glass of antimony, oxide of bismuth, various chlorides, iodides, and sulphurets, and many ordinary neutral salts with alkaline bases: in almost every instance the bodies subjected to this law are electrolytes. Sulphuret of silver is the only known exception; although many compound conducting fluids are non-electrolyzable; yet neither are these subject to the above law of variable conductibility.

2. Compounds, which may be considered as primary combinations of a single atom of one constituent, united to a single atom of the other, alone constitute the class of electrolytes; thus protochlorides and protiodides are electrolyzable, but not per-chlorides or per-iodides.

3. The decomposing action of any current of electricity is constant, for a constant quantity of electricity.

4. The electrolytic action follows the chemical laws of definite proportion; thus the same current which will decompose a given weight of water, will decompose proportional weights of other electrolytes, introduced into the same circuit, corresponding exactly with the proportional numbers representing the respective chemical equivalents of these bodies. This has been ascertained with regard to muriatic acid, protochloride of tin, iodide and oxide of lead, and many other bodies.

Mr. F. considers the quantity of electricity thus required for the decomposition of an electrolyte, as equivalent to that which, being naturally combined with its constituent ions, previously retained them in union. He estimates this quantity as very great; a single grain of water requiring for its decomposition a quantity of electricity equal to a very powerful flash of lightning!! We shall hereafter explain in what manner the galvanic electromotive apparatus, through the almost infinite velocity of the electrical current which it sets in motion, although of very low intensity at any

given *instant,* is yet able, in a short time, to pour forth such an abundant supply; the difference between a galvanic and common electrical machine being, that in the latter, though the intensity be greatly higher, yet the velocity of the current is incommensurably more slow.

Mr. F., in his views of the passage of the opposite ions to the extremities where they are developed, appears to agree with those before enounced by Grotthus, Biot, and others, namely, that they travel by a series of successive decompositions and recompositions, the anions to the anode, and the cations to the catode.

ON THE INTERFERENCE OF THE AERIAL WAVES PROPAGATED BY A TUNING FORK, &c.

BY ROBERT ADDAMS, LECTURER ON CHEMISTRY AND NATURAL PHILOSOPHY.

A KNOWLEDGE of the precise manner in which the interference of undulæ takes place, is of considerable importance in the investigation of the physical sciences, especially those of Acoustics and Optics. It is presumed, therefore, that every new case of interference has some value as confirmatory of that which is already known, or as contributing to elucidate the phænomena which are still doubtful or unexplained. With this expectation, I send for insertion in the West of England Journal, the following account of some facts which I have obtained in reference to the vibration of a tuning fork, conjointly with a resonant column of air.

1. When a vibrating fork is held over the mouth of a pipe, whose dimensions and form are such that the included air is unisonant with the fork, the sound of the latter is reinforced by the air of the former. (as first demonstrated by Professor Wheatstone.) Having lately been occupied in a series of experiments on the interferences of sounds, I have noticed some additional evidence. Thus, let an unisonant pipe be placed vertically, and a tuning fork held about half an inch from its orifice, and so that the plane which passes through both its limbs parallel to their length, be vertical, and consequently at right angles to the mouth of the pipe; then, by moving the fork parallel to itself, the sound will be very unequally reciprocated, according to the position of the fork, with respect to the pipe's mouth.

The intensity of the sound is at a maximum when the fork is over the centre of the mouth; it declines by an advance to the circumference, and is at a minimum, and inaudible, when *the plane* of the fork is coincident with a tangent to the edge or circle; the sound begins again and increases as the fork is transferred outside and beyond the pipe, where, at a certain distance, it reaches its maximum, for this position, and again diminishes. The same changes occur when *the plane* is held horizontally.

2. If, however, the before-mentioned plane be inclined to the axis or

mouth of the pipe, at an angle of 45°, the phænomena are no longer identical, but reversed.

With this inclination of the fork, let it be moved parallel to itself and over the mouth, as before, and now the sound will be the loudest when the fork is vertical to the circumferential tangent, will decrease by approaching the centre, and when there, will be inaudible; being the converse of the former.*

3. The branches of a tuning fork move simultaneously in opposite directions; and as each becomes the focus of a system of undulæ, it follows that the waves, having opposite phases of motion, must interfere; and as a consequence, the sound, which each limb would yield, if vibrating independently, must in the existing condition, be diminished.

With a view to prevent such counteraction, I held a fork in my hand; and whilst vibrating, scarcely audibly, I thrust one of its limbs into a cardboard tube, and found my expectation realised in the increased intensity of the sound.

Hence, when a fork is held in the air, not touching a table or other reciprocating surface, one of its parts gives a louder sound than both together.

Also the compound sound from two unison strings has a less power on the ear than the sum of their separate sounds, provided they be excited to motion, so as to move in opposition in the same plane.

Kensington, Jan. 1st, 1835.

* Neither the foregoing phænomena, nor another which I described before the British Association, at Edinburgh, can, perhaps, be satisfactorily explained until we are better acquainted with the theory of the tuning fork. And "the mathematical theory of the pulses it generates is (even in the estimation of Sir John Herschel) of the utmost complication, and of too high a nature to have a place in the Encyclopædia Metropolitana."—Sound, art. 119.

HORTICULTURE.*

Amaryllis Striatifolia Concinna, as we have named it, is a new variety, and the first which has bloomed out of a number of young seedlings presented to Mr. Miller in the spring of 1833, by the Rev. Dr. Swete, of Redland, who is a very successful cultivator of this truly magnificent family of plants. The seed was saved by Dr. Swete in September, 1832, from *amaryllis semperflorens*, fertilized with the pollen of *amaryllis superba*, and the plant which has now, for the first time at the Bristol Nursery, opened into bloom, is a splendid and distinct variety; it has a fine head of flowers of a bright rosy-red colour, with a broad white stripe extending from the base to the point of each petal, and is very finely scented, like

* We are indebted for this Notice, from the gardens of Mr. Miller, to Mr. M. Mayes, by whom the observations are made.—Ed.

amaryllis vittata; its leaves also are beautifully striped with greenish white, and are elegantly reticulated on their upper surface. It should be noticed that both the parents of this variety of amaryllis are themselves hybrids; *semperflorens* being a hybrid between *amaryllis acuminata* and *amaryllis vittata;* and *superba* between *amaryllis Johnsoni* and *amaryllis striatifolia;* and in this plant we can trace the intermixture of this, which may be termed a double hybrid, possessing the scent of vittata, the white stripes as in striatifolia, and the admixture of all in the shape and colour of the bulb, the foliage, and the flowers; yet its general appearance is very different from that of either of its parents. With the production of new hybrids of this interesting tribe from seed, we may go on without end. He who is in the possession of eight or ten distinct hybrid species, may soon, with care, increase them an hundred-fold by fertilizing them one with the other. It has been stated that hybrid plants will not produce seed, but in the case of this lovely tribe there seems to be no limit; for we are satisfied that they will bring their seeds to perfection, even through many generations of hybrids. Again it has been said that these varieties would not endure, but would retrograde into their original species; we only know that many of them would in such a case have a most intricate journey to perform! Many of these hybrids will produce seed if fertilized with their own pollen, though not by any means so abundantly as with the pollen of others; but they will give rise to precisely the same with their prototypes in every respect, so that the variety may be continued by seed as well as the species. Neither the species nor the hybrids will, we are well aware, produce seed so abundantly from their own farina, as from that of others; and there are several which will not produce perfect seeds under any circumstances. With respect to hybrids, it may be mentioned that they will not spring all alike from the same capsule of seed, but will vary, some more resembling the one, and others the other parent.

We expect that many other fine varieties of amaryllis will be in flower by the middle of this month.

Alstrœmeria is another beautiful and very interesting genus of the natural order of the *amaryllideæ,* of which there are now several species at the Bristol Nursery. *Alstrœmeria acutifolia,* (sharp-leaved alstrœmeria) is now in full bloom, and has been deservedly admired; its flowers are of a dark bright orange red, and from twenty to thirty in an umbel. It was cultivated, on its first importation into this country from Mexico, as a stove plant; but with little or no protection it will bear our ordinary winters, and make a very fine appearance in the flower garden; but the best situation for it is against a wall, as having a climbing stem it requires support. It grows from seven to ten feet in height, and continues in flower during several months. Mr. Miller's specimen has been in flower ever since last July; and if the winter remain mild, will continue for some time longer. Like all the alstrœmerias it will grow well in a light sandy soil.

Mr. Sweet has given a fine figure of this plant in his second series of the British Flower Garden, page 77, and mentions it as a native of Jalapa, in Mexico: it has been in this country about four or five years.

Arbutus Milleri, is a new variety, which has been raised at the nursery by seed from the scarlet variety of the *common arbutus,* and *arbutus andrachne.* It is far superior to any other variety with which we are acquainted. Its flowers are of a delicate pink colour, with broad leaves; and it is altogether a fine ornamental shrub, and will be a great acquisition to the pleasure ground. It has been flowering finely, but its bloom is now almost over.

Galardia Picta is a new species of considerable beauty, the seed of which was collected by Mr. Thomas Drummond, in Louisiana. It was raised from this seed at the nursery and at some other places, to which seed had been sent by the same collector. It has been figured in Sweet's British Flower Garden for December last, but the representation is from an original far inferior to the plant that flowered lately in the Bristol Nursery, in consequence of the plant from which the drawing was taken having been grown under glass. It appears to be hardy, and to flower most abundantly. It was raised from seed last spring.

Tropæolum Peregrinum, or fringe-flowered Indian cress, is a native of Peru, from whence it was introduced about the year 1775. But although so long a period has elapsed since its introduction, the plant is by no means common. It is said to be an annual, but it may be continued by cuttings in the same manner as the double nasturtium; it grows freely in summer in the open ground, but does not come into flower till October, when it should be removed into the green house. It is an elegant creeper, and well adapted for training round a wire trellis: our plant has at this time from three to four hundred flowers upon it, which are of a beautiful bright golden yellow, and being connected by a long and delicate stem, would almost make an observer fancy that he saw a number of miniature canary birds with extended wings, in the act of taking flight from so many small twigs.

Chimonanthus Fragrans, or *Calycanthus Præcox,* is not a new plant, but cannot be too generally known. Its deliciously fragrant flowers make it a most desirable object of horticultural cultivation; it is very hardy, and will grow in any soil or situation; but as its flowers open in the cold season of the year, they will appear to greater perfection against a south wall. Mr. Miller's plant is covered with flower, and scents the air for a considerable distance around it. There are two other varieties, grandiflorus and luteus, both possessing equal scent.

Bletia Florida, one of the *orchideæ,* is a fine purple-flowered stove plant; it has been in bloom for some time, and is likely to continue for a month longer.

Cactus, or Ceneus Truncatus, a large specimen grafted on *ceneus*

grandiflorus, with two hundred flowers, has been very fine, but is now almost over.

Amongst many other plants which are now in bloom, the following are most deserving of notice :—

Stove Plants	Neottia elata
	——— speciosa
	Euphorbia splendens
	Epidendrum cochleatum
Hardy Herbaceous Plants..	Tritoma pumila
	——— media
	——— uvaria
	Stenactis speciosus
Hardy Shrubs	Arbutus hybrida
	Mespilus præcox, or Glastonbury thorn.

The Camelias look well, and are beginning to flower, but will not be in perfection till February; of these and of our stove epiphytes, we hope to be able to give some account at a future time.

Bristol Nursery, Dec., 1834.

OBSERVATIONS
UPON
THE POLDERS OF FLANDERS.

The following observations upon the "Polders," or meadow lands, of the Netherlands, may perhaps be interesting to our agricultural as well as to our statistical readers. We propose in one or two future papers, to give an account of the bombardment of 1832, from the consequences of which many of these observations are deduced, as well as of the damage, direct and indirect, which it inflicted upon the city and town lands of Antwerp.

The greater part of Flanders, east and west, presents to the eye a vast plain, rarely much above and frequently below the level of the neighbouring ocean. Lands of the latter description are called *Polders*; they were originally reclaimed from the sea, and are only preserved from submersion by strong dykes, or banks of earth, and sluices.

The Polders exhibit the chief agricultural strength of the Netherlands, and constitute the larger and perhaps the more valuable moiety of the country; they include seventeen of the richest provinces, and among them Brussels, Antwerp, and the Sas de Gand, extending even to Nieuport and Cambrai. Their superficial content has been calculated at 140,000 hectares—about 350,000 acres English; their total value at 150 millions of florins; and if, which is a fair estimate, we take, with the latest authorities on the subject, a mean of twenty-five hectares, we shall have 5,600 proprietors directly concerned in their security and cultivation.

The Polders were originally vast morasses, overflowed twice in the twenty-four hours, and gradually elevated to their present level by the depositions of successive tides; a process admirably exemplified in the neighbourhood of this city, along the shores of the Severn and Bristol Channel. By degrees, as the level of these depositions became beyond the reach of an ordinary tide, rank grass and weeds sprung up upon the soil, and the neighbouring inhabitants surrounded it with a dyke, previous to taking it into a regular state of cultivation. By such means, by the addition of manure, by being permitted frequently to lie fallow, and by being carefully purified from weeds, the Polders annually increased in value, and arrived gradually at the condition in which they are usually at present found.

The produce of the Polders of East and West Flanders is oats, barley, hay, &c. affording excellent feed for horses, cattle, and sheep.

The Polders are divided into three principal classes:—

First, pasture and arable land, of the first quality, neither too stiff nor too dry, and pulverising readily beneath the harrow.

The second class includes meadows of an inferior quality, arable land, of a stiff clayey nature, breaking into lumps beneath the harrow, and forming a hard crust, through which the seeds can with difficulty shoot; this class is therefore chiefly laid out in turf for grazing.

Grass lands set for hay, compose, for the most part, the third class; such lands sometimes, though very rarely, equal in produce the best pasture, but usually they are inferior even to the meadows. The arable lands of this class afford scarcely any return. Agricultural authors treat of a fourth class, comprising lands of a dry sandy nature, almost unfit for any kind of cultivation.

The proportion observed between the above classes, is exhibited in the annexed table, taken from a recent authority upon the subject.

	Classes.	Hectares.		Classes.	Hectares.
Eastern Flanders.	First....	594	Contested Territory.	First....	110
	Second..	1,386		Second..	257
	Third ..	1,386		Third ..	257
	Fourth..	595		Fourth..	111
	Total..	3,961		Total..	735

The proportions for Western Flanders are nearly the same.

Lands of the third class are not unfrequently parcelled out in small lots as potatoe grounds for the poor, at a rent of about ten cents per verge, or nearly sixty-eight florins per hectare. As the ground on which the potatoe grows requires a thorough digging, its cultivation is not found materially

to diminish the fertility of the soil. The common rent per day for a cow is twenty-two cents, and two cows are allowed to each hectare. The season lasts six months, from mid-April to mid-October, giving a rent per hectare of about eighty-four florins. Inferior lands yield a return of from sixty to sixty-eight florins.

The inundations to which the polders are liable, are of three kinds;—from rain water, from brackish water, and from sea water. When the September rains fall in greater abundance than usual, the means employed are found inadequate to carry off the surplus water, and the low lands are inundated, nor can they be completely drained before the following April.

To inundate the higher lands, artificial means are employed; and thus frequently during the interval we have indicated, the country presents the aspect of a fresh-water lake, the villages and their homesteads being alone above water. Such inundations are injurious only to the pastures and arable lands; to those set for hay, they are, when confined to the above period, positively beneficial, from the deposit which they leave upon the soil.

The influx of brackish water occurs in April and May. The tides, elevated by the March moon, and forced up the mouths of the rivers by the powerful north-westers, obstruct the egress of the rain water, and together they overflow the embankments.

In proportion to the admixture of salt water, is calculated to be the injury inflicted upon the deluged lands.

The salt water inundations are effected entirely by the sea, and occur usually in June, when the fresh water has sunk to its summer level. The damage is very considerable, as the earth, being in a dry state, imbibes a large quantity of deleterious saline matter.

In considering the amount of damage inflicted by the above inundations, they should be divided into two classes; the ordinary, or those attendant upon every species of inundation; and the extraordinary, or those caused by inundations of a particular description. Now those inflicted during the late siege, were entirely of the latter description; the water admitted was exclusively salt, and the lands inundated, from their natural fertility and from their proximity to the markets of Antwerp, were of great value.

The damages sustained by such of these Polders as were inundated by the military operations of 1830 and 1832, have recently come under the consideration of the Belgian government, and the report of the surveyor general upon the state of the land, which we have not had an opportunity of seeing, is said to afford much useful information.

The losses consequent upon an inundation, may be divided into two classes.

First, those which result from the diminished produce of the inundated land, from the time of the inundation until all traces of it shall have dis-

appeared; and secondly, the expenses necessary to get rid of the water, and to repair and maintain the dykes and sluices, depending of course upon variable circumstances, and not reducible to any general rule.

With respect to Eastern Flanders, ten years is considered as necessary for the complete recovery of the greater share of its Polders, five years for a smaller share, and two years for a very small remainder.

The English reader, perhaps, is scarcely aware, that these Polders, of such immense agricultural importance, are no less valuable as a military defence. During the struggles between the Spanish and the inhabitants of the Netherlands, in which the unconquerable spirit of freedom was so nobly displayed by the latter, they with their own hands cut down the dykes which they had with so much skill and labour constructed, the more effectually to baffle the invader; and there are in truth few modes of defence more effectual than such a measure. Too shallow for ships of war, and too deep or muddy for land troops, the annals of the wars in the Netherlands prove the inundated Polders to have provided a barrier which it required no little skill and perseverance to overcome, and which enabled the Dutch, though the weaker party, to prolong the national contest, until the Spaniards were finally disheartened and beaten.

In later years, the agricultural wealth of the Polders has been sacrificed for a similar purpose. In 1832, the whole of that extent of country, called the "Tête de Flandres," extending for miles along the Scheld opposite to Antwerp, was laid under water; only a few forts, a village, and a solitary causeway remaining visible. This inundation was the work of the Dutch, and was effected by means of a cutting, or "coupure," in the dyke opposite to the citadel of Antwerp. These lands, which had been injured in 1830, remained until a short time ago, still under water; and from the long continuance of the inundation, and the quantity of saline matter with which the Scheld is there impregnated, it seemed to be the opinion of practical men, that upwards of twenty years must elapse before they could be restored to their former productiveness. Those who remember the high tide which some thirty years ago laid the low grounds below Kingsweston under water, can form some idea of the serious and lasting consequences of such an influx.

We add the following calculation, reduced from more extensive tabular returns, drawn up for Eastern Flanders, under the direction of the government; it contains the average of three Polders, Calloo, Clara, and Passegueille, the two latter of which formed part of the contested territory.

Of these Polders, the total content is about 6,328 acres; the total inundated, 3,837 acres. The duration of the inundation was, upon an average, thirty-nine days, in the months of August, September, or October, 1830—31. The expenses of repairing the dykes were estimated at about £2,071; of the sluices, at £2,245; giving a total of £4,316 for the amount of repairs. The average time required before the Polders would

equal their fertility previous to the inundation, is about seven years; their average annual value before the inundation, fourteen shillings per acre; and from its commencement until all traces of it should have disappeared, five shillings; leaving a loss from the diminished produce of the lands of about £12,086, and a total direct loss from the inundation of £16,402 : 11*s.* upon the above three Polders alone.

REVIEW.

Geometry without Axioms. By T. Perronet Thompson, Queen's College, Cambridge. Fourth Edition, 1833.

The study of Geometry, rising, like most other sciences, out of utility, was at a very early period fixed upon for its value as an exercise of the reasoning powers: nor has all the brilliancy of modern analysis ever displaced the earlier science from its claim to pre-eminence in this respect. Not as though its reasonings were more rigorous than those of Algebraic Mathematics, nor as though the latter did not vastly surpass the former in the efforts of inventive genius and subtle discussion: but because the subject on which Geometry treats is far more popular in its character, than any of the higher branches of Analysis can be made. But few can afford the time and application needed to master these latter, nay, to gain an apprehension even of the definitions, so far as to conceive the spirit of the method: while all have a more or less accurate notion of spheres and cubes, angles and distances. The subject matter is familiar, (if it be but treated as such) and, like the first principles of Algebraic equations, affords a method of calling the attention to accurate processes of reasoning; without so filling the young student's time, as though all were to be professed mathematicians.

When such is the object for which Geometry is pursued,—not for the sake of its results, but for the sake of its processes,—we cannot easily be hypercritical upon the soundness of the reasoning. That which would be mere cavilling, in review of a practical treatise, may constitute valid objection against a treatise which is proposed as a model of perfect reasoning. In such case, if the link of the argument be broken, the error or defect *should be avowed.* To hush up the matter, and pawn off imperfectly connected propositions as demonstratively proved, is like training a student in the habit of smothering his doubts, and taking proof for granted. Perhaps in this matter geometers have been far less honest than they should have been. It is certainly strange, that when *geometrical,* as opposed to *analytical,* is popularly apprehended to mean *rigorous* as opposed to *lax;* possibly no algebraic treatises have flaws so fundamental as those which exist in the common elements of Geometry. And what is worst, geometers

are prone to disguise their incapacity to prove what they ought to prove, under the specious name of axioms, which they allege to be self-evident truths.

A very slight reflection must show every man who opens a geometrical treatise, how many propositions are demonstrated by geometers, which are yet to him quite as self-evident as those which they style axioms: therefore he will at least expect some reason assigned, why some more than others should be thus designated. But it needs no great insight into the matter, to perceive further, that the setting up of axioms is *a mere afterthought:* that is, no geometer calls a proposition self-evident, because he intuitively discerned it; but because, after trying, he failed to prove it. Further: it is easy to see, that of half a dozen propositions equally self-evident, the geometer selects arbitrarily which shall be his axiom: one will do as well as another; but one or other he must have. This appears exceedingly like a *petitio principii.* If done openly, with an avowal that it should not be so, the student has fair warning: but when all is smuggled under fine words, axioms, postulates, self-evident truths, &c. a mist is thrown over the principles of abstract science, and false philosophy is so far inculcated.

The only circumstance under which there appears the least pretence for axioms, is, when a definition is notoriously in defect. We all know that there must be some stop to defining. If we be asked to define the terms of our definitions, the matter may be pushed back and back, till we are in inextricable confusion. We are then to expect terms which involve ideas so easy and so primary, as that he who alleges them to be incapable of definition, will say nothing unplausible. We would give in illustration the words Quantity and Equal. If a mathematician finds it necessary to reject all the definitions that are offered of these words, on the ground that the words themselves recur in the very definitions alleged; he may think himself forced into another track, viz. to lay down a set of propositions concerning the words in question, [as, quantities which are equal to the same are equal to one another, &c.] which propositions, taken together, shall adequately restrict and settle the meaning of the words. In this view, a set of axioms are substituted for a definition, precisely as a set of functional equations for the explicit declaration of a function. Thus, if the defining of Napier's logarithms were attended with any difficulty, the two following *axioms* would amount to a definition.

$$\log x + \log y = \log (xy) \ldots \text{for all values of } x \text{ \& } y \ldots \text{and}$$
$$\log. 2{\cdot}7182818 = 1.$$

But of course we are here beset by the difficulty of determining, à priori, whether we have given too much data for the result; or in algebraic language, whether our equations have a possible solution. And this objection renders it quite unprofitable to adopt axioms concerning any thing that is

shortly to be assumed as in substantive existence: for we have afterwards a new process to secure ourselves from fallacy. Thus, though we may, if we please, use axioms to fix and ascertain the idea of *straightness*, it will remain to be proved that there is between every two points one line and one only conceivable, to have the property of straightness.

But when a geometer professes to define all his terms, he has not the shadow of a pretence to put forth axioms. If the definitions are sound, they are infallibly adequate to prove all truths essentially connected with them. If the definitions be inadequate,—descriptions rather than definitions,—it should be avowed. Indeed the words Equal and Quantity are not ordinarily defined by geometers; hence the axioms which relate to these terms are bearable enough: (though they belong to the earlier theory of Quantity and Number, on which all Mathematics is based; and not specially to Geometry:) but those axioms which involve the terms *line*, *angle*, *straight*, &c. are nothing but unwarrantable assumptions, as all these have been (ill or well) defined.

It is easy to see the analogy between axioms in pure science and laws in mixed science. The only reason why a treatise on Hydrostatics needs to be based on the experimental laws of fluids, is because the writer cannot or will not give a definition of *fluidity*. If he does give a definition, he turns his treatise into pure science; but it is possible then that he is amusing himself with writing on that which does not exist. A metaphysician might yet arise among us, who should not unplausibly maintain, that Geometry, though it treat not of substantial bodies, yet as it treats of space, which is a something with which we have acquaintance through the senses, ought philosophically to be regarded as one of the *mixed* sciences. Such a one would not be inconsistent in making simple experiments the basis of his reasoning: and his justification would be in this, that the words space or solidity are undefined or illdefined: a circumstance which seems most remarkably to escape notice.

We are led to the following observations by the perusal of the little book which is named at the head of this article. The number of past fruitless attempts to get rid of the twelfth axiom of Euclid, ought not to make us look with contempt on new efforts, until some one has shown that it *cannot* be proved. But our present author, in his fourth edition, which we have before us, has not confined himself to the much vexed question of parallelism: he has spent much labour on the definitions of the straight line and plane. And what gives new interest to his treatise is, that he has set out on an entirely original method, making the discussion of certain properties of the sphere precede the definition of the straight line and plane. This makes the book peculiarly worthy of notice, whatever judgment be formed of it: and we propose to set before our readers some account of his object and method, before making our own remarks on the execution.

The object proposed is to prefix or insert propositions to the first book of Euclid, in such wise as to make the argument continuously logical, without employing axioms. The defects are manifest. A straight line is defined indeed by Euclid, but so defined as to be nowise clearer than before; and Euclid himself never appeals to the definition, but to his axioms. This is a less guilty fallacy than that involved in his definition of the plane, in which an assumption is smuggled; since he proposes more than enough data for the generation of the plane surface. To remedy this, Mr. Thompson has an "Intercalary Book," or more properly, an "Introductory Book," ending in the establishment of that property of the plane, which brings us from our airy flights on to the terra firma of plane Geometry. He proceeds to dovetail the rotten parts of Euclid's first book, but of course with the twelfth axiom chiefly in view. After various minor flourishes, he concludes in an appendix by summing up and refuting all other proofs that have been offered of the main principle of parallels.

His *mode* of proceeding is as follows.—Equality of distance is determined by means of supraposition of points, even before the straight line is defined: it is then easy to define a sphere. He proceeds to prove his first important proposition, that *spheres touching externally touch only in a single point.* It readily follows that this point *lies evenly* between the centres: that is, turns about itself without change of place, if the two spheres being united as one mass revolve together about the two centres. Mr. T. does not use the word *evenly;* but it is very appropriate; and, so explained, makes Euclid's definition of a straight line adequate. (Such is nearly Mr. Leslie's view.) It follows, that by altering the size of the spheres in contact, the point of contact is made to generate a path, connecting the centres, every point of which lies evenly betwixt the centres; and this is called a straight line. Out of this definition instantly flow all the primary properties of the straight line. Mr. T. labours unnecessarily at them.

The second proposition of difficulty is, to show that *intersecting spherical surfaces coincide only in a circle;* which is virtually equivalent to Eucl. I. 8. that the angles of a triangle are determined when the lengths of the sides are given.

His third difficult proposition is to generate a plane, and to show that his plane has the property which Euclid makes its definition. And so ends the Intercalary Book.

There is moreover introduced into Euclid's First Book, to prove the twelfth axiom, fifteen pages of close print, in this fourth edition. Diagrams occupy a portion of the pages, and our author's style is that of over full reasoning; leaving not even the very obvious steps and reasons to be supplied. The quantity of matter is not therefore so formidable as might appear: yet we must call it very hard and unreadable. The proposition however which he is aiming to establish, is this: that "if the angles at

the base of a tessera be acute, the angles opposite to the base are not right." We should add, that by a *tessera* he understands, a trapezium which has a diameter perpendicular to one of its sides.

We have now to remark on the character of his reasoning, in these his four main propositions. The *first* of them has four cases; that spheres cannot touch externally, neither in a surface, nor in a self-rejoining line, nor in an open line, nor in isolated points. The proof of the first case is virtually grounded on the principle, (we fear we ought to say *axiom!)* that if any portion, however small, of a body's *surface* be immoveable,—as if for instance it be glued down to another surface that is immoveable,—no oscillating motion, however small, is conceivable in the former. We suspect Mr. T. would have bantered Le Gendre very cleverly for any such assumption, telling him that for aught he knew, an axis of rotation might *have breadth.* Did it ever occur to Mr. T. to inquire whether he could *prove* that it cannot? We do not say he cannot: but if he can, it should be prominent: while at present he labours hard in giving reasons where we want none, and here he does not at all clearly tell his reader what he is assuming, or why. We had written various objections to the proof of the three remaining cases: wherein we exceedingly disapprove of the vague and even unintelligible language of *above* and *below,* before we have defined *straight line* or *plane,* and when they cannot be changed into "this and that side of such and such a surface:" and equally do we disapprove of his arguing that "the line C D cannot turn *its face (!)* to all sides in succession without change of place;" more especially when he has not yet proved that C D may not be such a line as we afterwards call *straight.* His last case is proved only when there are *two* isolated points, and fails when there are *three.* We had accumulated yet more objections, when we met with the Quarterly Journal of Education, No. XIII., in which it is remarked that the proof applies quite as well to intersecting spheres, as to spheres in contact. This remark is obviously and instantly fatal to the last three cases: but we think slight verbal changes would enable the first to evade the charge.

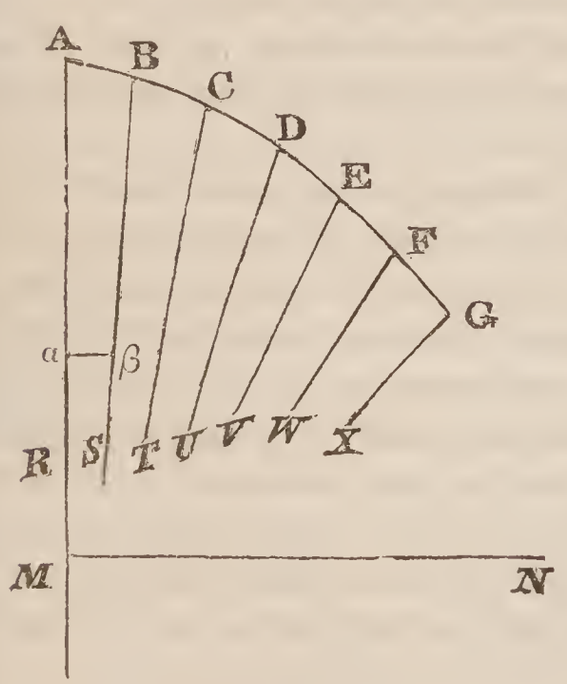
We are sorry to think the failure of this proof is so decisive: for the proposition is to us the most interesting in the book. It seems an original thought to prove directly from first principles, that the external contact of spheres is but in one point; and we are not at all in despair that it may be done: but if done, it must be done by perspicuous and easy proof, or we shall not value it. Out of this proposition instantly flows the inference, (which we are surprised at Mr. T.'s not drawing) that a straight line is the shortest between two points, and is therefore *the measure of distance.* For it is manifest that no line connecting the centres can be the shortest, (or as short as any) unless it pierce both surfaces in the point of contact. But while we think that Mr. T. has decidedly failed of proving his proposition, he has usefully set forth what is meant by three or more points *lying evenly,*

and called us to consider whether the early introduction of the sphere would not tend to perfect the doctrine of the straight line.

On his second main proposition, (his eleventh) we have to remark similar defects as in the former. It has two cases, of which the former is doubtfully proved: the latter we think is certainly not proved: for he does not show that the points M, N, O, P may not be in one straight line; and this is essential to the proof, if we rightly understand it. Yet we confess it is very hard; so hard as to make us doubt every thing; where indeed all the hypotheses are so monstrous, that the mind is bewildered in the midst of so many false lights. When it is hard to say what is more manifestly absurd than what, the *reductio ad absurdum* is a most dangerous proof; needing a perpetual effort of most painful vigilance, even from practised mathematicians.

His third main proposition is satisfactory, though excessively tedious. But in fact, there is no difficulty at all in the doctrine of the plane, so soon as Euclid I. 8, has been established; which is virtually Mr. T.'s eleventh proposition, just noticed. For if a right angle be first defined, (which is not difficult) we may generate a plane by supposing one leg of the angle fixed while the other revolves round it; then the general property of the plane is readily established by a method analogous to Eucl. XI. 4.

We now feel ourselves bound to attempt to convey to our readers some notion of his method of treating parallels, the more especially as other reviewers decline the task, which is not an easy one. Anxious to do him justice, we have diligently studied what he rightly, but funnily calls, "the pinch and nip" of the argument; and we would fain put to him some *vivâ voce* questions, where the slippery materials appear to elude the grasp of our forceps. We shall, without apology, throw his matter into the form that strikes us as most intelligible to our readers.



Conceive the equal angles R A B, A B S in a given plane, which *may* be taken so small as that A R, B S meet towards R and S; while if they be right angles, we know that A R, B S will meet neither way. The question to be decided is, whether they will certainly meet, if the angles be *ever so little less* than right angles.

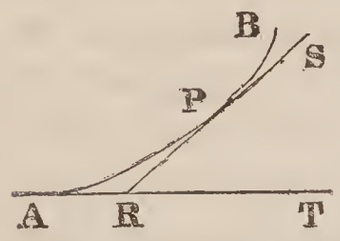
If possible, let it be otherwise, (for precision, we might suppose the angle the least possible, consistently with the condition of the lines not meeting.) Suppose the system to turn about B S, till R A B imprints its counterpart T C B on the plane, at the opposite side of B S. Similarly

we may produce the systems T C D U, U D E V, V E F W, W F G X.. &c., *ad infin.*—all counterparts of the first. It follows also that C T never meets B S, nor does D U meet C T, nor E V meet D U, &c... so that *à fortiori*, no line in the series as F W or G X can meet A R. This puts the absurdity of the original supposition in a striking light before the eyes: but this is not to give reasons for the thing. Let now M N be perpendicular to A M. It is then easy to take the distance A M so short, that M N may meet the crooked path; but if A M be great, it is not so obvious that this will happen. In reality we know it will not; for we know that that path will bend round and cross A R—but this is excluded by hypothesis—so that the argument is a dilemma; *either* the path shall cross A R, and then all we want to prove is conceded; *else*, however distant M may be, I SAY, M N shall meet the path. Here is the pinch and nip! "For else, let A M be the least distance such that M N does not meet it. Then A G, M N are infinite lines asymptotic to each other; of which the latter is straight and the former is *convex* towards the latter, which is absurd." Thus we have ventured to supply our author's reasoning. It seems to us, that the effect of his labours is to reduce the twelfth axiom of Euclid to another much more obvious, and which perhaps may be proved, but which nevertheless he has not proved; that "a crooked line cannot turn its *convexity* towards a straight line which is *asymptotic* to it." If this be granted him, he proves that any tessera A B β α [cut off from A R and B S, A α = B β, and join $\alpha\beta$] which has the angles at A and B acute, cannot have the angles at α and β right; which leads by easy steps to Euclid's twelfth axiom. We conceive he is still engaged with the second part of the dilemma. *Either* the crooked path meets A R, and so the twelfth axiom is granted outright: *else* he proves this and that about the tessera, whence ultimately the twelfth axiom is still made to follow. If we be right, Mr. T. ought not to have isolated his propositions as he has done.

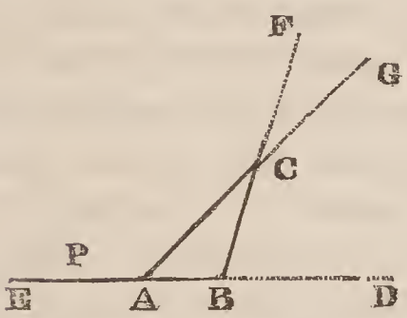
And this strikes us as a sufficient reply to the startling objection of an ingenious reviewer,* that for any disproof which Mr. T. has offered, the point D might coincide with A, E with B, F with C, &c. . . . . for *all conceivable values* of the angle and length. We are not surprised that Mr. T. did not foresee so extraordinary a thought, and we give credit to our contemporary for the inventiveness of it. Doubtless it would vitiate all Mr. T.'s after-reasoning: but it would amount to a direct concession of all that he is seeking to prove; viz. that the path must meet A R a second time. The objection however was just, as levelled against a proposition, which ought not to stand (we conceive) as a positive truth, but as on a hypothesis still kept up till the chain of argument is complete. The reviewer, though acute and clear, had evidently a strong prepossession against the possibility of Mr. T.'s success; and was deterred from reading further, when he met

* Quarterly Journal of Education, No. XIII.

such a fallacy. We believe the tedium of Mr. T.'s proofs was the true dissuasive with him, and we acknowledge the power of such a sedative.

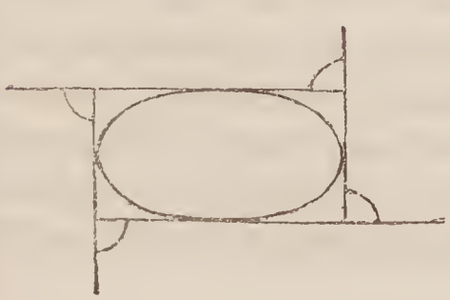


The attempt to prove that a line cannot turn a convex front towards its asymptote, leads directly to the consideration of deflections and deviations. Some of our readers may exercise their wits in confirming or disproving the following:—If a point P describes a line A P B which perpetually deflects from the tangent towards the same side, and A R T, R P S are tangents at A and P, it is ordinary to assume the $<$ S R T as the measure of the total deflection performed through the arc A P: and this, by reasoning from first principles, without any reference to the doctrine of parallel lines. Is this warrantable or unwarrantable?



Now consider a similar case. Let A B C be any triangle: prolong A B to D: I say, the $<$ C B D $=<$A $+<$C. For let B A, B C, A C be prolonged to E, F, G: and let any point P describe the crooked path E A C F. It makes at A the deviation G A D, and at C the deviation F C G; and in the rest of its motion does not deviate at all. But in describing C F, it is manifest that it has deviated from the straight line E A D by the angle F B D; therefore,* *since the total deviation is equal to the sum of the partial deviations,* the $<$F B D$=$ $<$G A B$+<$F C G; or $<$C B D$=<$C A B$+<$A C B: which was to be proved.

We are sure Mr. T. would desire no *mercy* shown to any of his proofs, but only fair play. Indeed he handles his antagonists very roughly; (for all his predecessors in the attempt to solve the problem of parallels appear as his antagonists): and to say the truth, we do not admire the decision with which he puts his extinguisher (in his Appendix) on some attempts which have much interest for us, as hopeful and admitting improvement. We do not assent to his condemnation of M. Bertrand's proof. But we especially have in view Legendre's analytical proof,—not that we approve the introduction of algebraic considerations:—we speak of the fundamental principle, which, to say the truth, Mr. T. seems to us not at all to understand. Indeed he himself complains, that when they insist on the "angle being a portion of a finite whole; and the straight line, of an infinite whole;—there is no reasonable or demonstrated connexion between the



* Playfair's proof assumes more than this; viz. that the total deviation in a self-rejoining line is four right angles; which seems equivalent to assuming outright what he is proving, that the four exterior angles of any figure together equal four right angles. Yet it may furnish suggestions.

facts alleged, and the consequences assigned to them." Would Mr. T. excuse our attempt to clear the reasoning? as we think the metaphysical question worthy of attention, and moreover since it is very easy to deduce from it all that we desire, *without* appealing to algebraic notions. We conceive the argument to stand thus:—"Lines cannot be calculated from angles alone: FOR when angles are given, no linear unit is hereby given. It is OBJECTED that this proves too much; for when lines alone are given, no angular unit is hereby assigned; yet angles may be hence calculated. We REPLY, Not so; of angles there is an extreme value, viz. the sum of two right angles; which, for any thing which *à priori* we know to the contrary, might virtually furnish an angular unit; and this *à posteriori* we positively know to be the case: but contrariwise, a straight line has no maximum or minimum value. The cases then are not parallel, and the objection falls to the ground." Whether the original argument be valid, is to be considered again; but assuredly the reply which Mr. T. thinks so little to the purpose, is directed very accurately against his insuperable objection. But he, as Mr. Leslie, seems to have much spite against this principle. That lines *cannot* be calculated from angles, is a proposition notoriously true; and the truth of which we readily learn, without wading through the properties of triangles. Why should he be incredulous as to the possibility of giving a direct demonstration of it from first principles?

But he meets us on another ground: "The *substantial inference*," says he, "is, that they have confounded the quantities which Euclid in his book of Data would call *given*, with the quantities which must be employed as elements in actual calculation." And here Mr. T. himself makes a great blunder: and we are disposed to think he has more acuteness in detail, than sound philosophical views of the science. His very example might have confuted him. If *a*, *b*, *c*, are the sides of a triangle, and A, B, C the opposite angles; we know *c* is determined when a, b, C are given. "Yet," argues he, "c must be collected from the formula—

$$\tan \frac{A-B}{2} = \left(\frac{a-b}{a+b}\right) \tan \left(90^\circ - \frac{C}{2}\right)$$

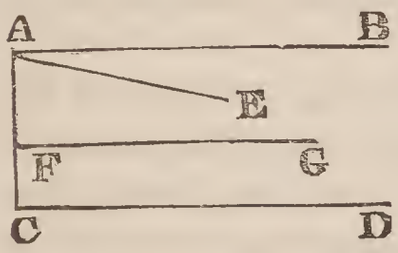
Here start up among the *practical* elements of the calculation *two straight lines* in the shape of the tangents of two arcs," &c. He would seem to forget that c is at once determined by the formula—

$$c = \sqrt{a^2 + b^2 - 2\,a\,b\left(1 - \frac{C^2}{1.2} + \frac{C^4}{1.2.3.4} - \&c.\right)}$$

but to found an objection to Legendre's reasoning, on the idea that the tangents and the cosines in the tables are *straight lines*, is truly extraordinary—as though any linear unit were determined by them. With equal want of consideration he compares a hyperbolic arc with a straight line, as though "new elements, such as *major and minor axes* might start up in the

case of the straight line." He forgets that we *already know* a straight line of unlimited length to be determined by *any two points* in it. Give five points in a hyperbola, which is only just enough, and we shall find no "new elements start up." But in fact his distinction between the *data* which *determine* the value of quantities and the *elements* whence those values are calculated, is utterly untenable and unphilosophical. Suppose the central angle of an elliptical sector is given, and the axes of the ellipse: if these are enough *data to fix* the length of the arc, then they are *sufficient elements for its calculation,* however many be the intermediate shifts by which the ultimate result is obtained. If Mr. T. can disprove this, he will give a fatal blow to the whole of the modern analysis. This is in fact its *fundamental principle,* wherever we reason concerning functions whose form is as yet unknown.

Before quitting this head, we will show how concisely the doctrine of Parallels may be proved from the principle that "lines cannot be calculated (nor therefore be determined) by angles alone." Let A B, C D be each perpendicular to A C; and let A E divide the angle C A B. If then A E, however far prolonged, does *not* meet C D, shorten the distance A C, and it is manifest that there is some least distance A F, in which C D, coming into the position F G, (still perpendicular to A C) is a true asymptote to A E. Then the distance A F is determinate: yet there are no data to fix it but the angles at A, which is absurd.



To remark generally on Mr. T.'s philosophy; while he aims at exceeding precision, we often find him lax, or as we judge, erroneous. He has retained the old definition of a solid, "that which has *length, breadth,* and *thickness*"—containing three words positively unintelligible till we conceive of three rectangular axes. His definition of equality is exceedingly questionable, as it involves us in the well-known paradox, that as a circular area, however cut up, would never fit into a square, therefore no square can be equal to a circle. Yet it is on this definition that he rests for abolishing all the axioms that are not specially geometrical. He indeed *assumes* that "all surfaces are of one kind," as regards magnitude; without commenting on the difficulty. We have already complained of the laxity of *above* and *below,* and of the *faces of a line* that may be straight, or may have double curvature, for aught we know. We disapprove also of his defining an angle to be a plane surface, when he reprobates all inferences drawn from it. "All references," says he, "to the equality of magnitude of infinite areas, are intrinsically paralogisms." We are not at all convinced of this. Yet if an angle be a surface, it is an infinite surface: and when one angle is said to be double of another, it must mean that one infinite surface is double of another infinite surface. It is surprising that he should think any thing gained by the change. In his Appendix, how-

ever, we were chiefly startled by the inconsistency of a passage which seems to show that he regards Geometry, as a science whose *elements* may possibly depend on the planetary system. He asks how we could tell *à priori* that "Nature," instead of making the angles of a triangle equal to two right angles, had not made their sum depend on the relation of one of their sides to *some grand modulus existing in nature, suppose, the radius of the earth's orbit.* If this be for one moment even conceivable, all Geometry must be based on experimental laws, and nothing then can be so unreasonable as Mr. T.'s aversion to appeal to the senses. We trace however the same indistinctness of apprehension, when he complains of Euclid's definition of a straight line, as being "an identical proposition." Had he said, "the definition itself needs an explanation," we should assent. But his tone seems to show, that he considers identical propositions as nugatory. *All* propositions in *pure* science are as truly identical as the binomial theorem and the multiplication table: yet they are not therefore nugatory. Either geometrical propositions are such; or Geometry is a *mixed* science, and must be based ultimately on sense. We can find no intermediate view.

We further feel that Mr. T. inadequately appreciates the force of the objection; that "a proof is too difficult;" and again, that "the parts of a subject are straggling." He says: "It may be a great irregularity, that *nature* should not have framed the elements of Geometry, so as to present a concinnous whole;" but "we ought not to quarrel with *the dispensation.*" If indeed our object were to ascertain the certainty of a practical truth, of course we should be thankful to have *any* demonstration: and where the truth is such as no man is aware of till it is formally proved, we do not complain if the proof be difficult. But when the mind has a direct and distinct perception of a truth without proof at all, it cannot be the natural method to lead us through many tedious and intricate ways to arrive at it. Let an intelligent person unversed in Mathematics be asked "whether spheres, if very large, might touch in more points than one: and probably his first conception will be that they may; because he unawares appeals to experience, by trying to conceive how it would be to his eye. But when reminded that it is owing to the roughness of the surface and the compressibility of the material, that they come into contact more exactly: he soon convinces himself that *perfect* spheres would touch but in one point. It is then clear, first, that the truth is not intuitive; next, that it is not learned by experience; thirdly, that it is not gained by wading through a whole book about the triangle and circle, nor yet through Mr. T.'s long proof. The mind does certainly find some short cut, connecting the definition of perfect sphericity with the property alleged: and by analysis of the vulgar reasoning, the philosophic geometer should endeavour to arrive at the natural method. By this not only would the study be made more pleasant and satisfactory, but more light would be thrown

on the processes followed by the mind. With such views, we much deprecate the artificial system and unbending style, pursued in most geometrical treatises. Indeed we suspect that Mr. T. practically mistakes formality for rigour; and thinks that his proofs are more cogent, because he puts in premises which in ordinary reasoning we suppress. If a man reason thus: "Good statesmen are valuable to a country: Lord Liverpool is a good statesman; therefore he is valuable to the country:" do we think his argument the sounder for the affected formality?* It may be requisite now and then; but is disgusting in the extreme, and painfully perplexing, if much carried out. The moment we quit Geometry, we give up the innumerable formalities of etiquette therein insisted on, (and to which Mr. T. seems much attached,) nor is it conceived that we lose in rigour. In fact† all illustration, so that it be marked off *as* illustration, tends to rigour, by giving more vivid apprehensions: while it relieves the tedium of dry reasoning. But as regards the *order* of a geometrical treatise, nothing, we apprehend, need be said of this *à priori*. Let only the natural methods of proof be well analyzed, and some luminous order will assuredly result; though it may be of a kind that we did not anticipate. But we do think that the appearance of complete disorder, is a most serious presumption against a geometrical compendium: the more especially since the value of mathematical study is *quite as much* in training the mind to a habit of clearness, as in the bare apprehension of what is good and what is bad logic;—nay, we should say, *much more*. It is a valuable habit, to discriminate quickly what is easier, what is more difficult; what is best proved from what; in what order truths must be set before the mind:—but a geometrical work which is *just not* fallacious, may train us to the very reverse of this.

And this leads us to express our conviction, that no patching of Euclid will make his Elements a work worthy of the eulogiums that have been lavished on it. We do not complain that it is ill adapted as an introduction to modern Mathematics, (though that be quite true); nor that he has various petty flaws; nay, nor that he has fundamental defects; (for we are supposing them all mended up:) but the treatise will still remain disordered, crude, and formal. We will take this opportunity of throwing together reasons, why all pretence of making his work the text book should be abandoned.

The natural connexion of subjects is broken, first, by the strange introduction of ratios in the fifth book; secondly, by interweaving with his theorems problems of mere construction. We shall speak of each sepa-

* Our illustration is perhaps too strong. We only mean to say, that his proofs would gain clearness and pleasantness, and lose nothing in rigour, by being less diffuse.

† Mr. T.'s Scholia are very good; and his explanations of many terms would be serviceable to a beginner, *though not to a person capable of reading his book.*

rately. No good reason appears for treating on ratios in a geometrical treatise at all; but if any where, it should be in the introduction; because at present he is forced to delay to his sixth book what should have been partly in the first and partly in the third. It is objected that the fifth book is too hard for a beginner. But that is the author's own fault, for taking so extraordinary a method. Oh! but, say the advocates of this extolled book, it is so geometrical! and so philosophical!--We apprehend that if it be really "geometrical," this is a fault; for a treatise on ratios ought no more to be geometrical, than astronomical or optical. But if it be meant, that it is adapted to those who understand nothing of Arithmetic, then we reply that such will remain incurably ignorant of ratios, though they read Euclid fifty times. And this brings us to the boasted philosophy of the method, which we venture to describe thus. Having given a useless definition of ratio, (which R. Simson rejects,) he then gives his serviceable definitions of the phrases, *same ratio, greater ratio, less ratio, compound ratio;* in such wise, that the words *greater, less,* &c. have new senses,* or rather no sense at all as isolated words, any more than *cir* and *cle* of the word *circle.* Accordingly it becomes necessary to prove that "Ratios which are the same with the same ratio, are the same with one another." Thus the upshot of this treatise on ratios, is, that we do not and may not know what "ratio" means. For if we do know, then since greater and less and same (or equal) are well known terms, it is unlawful to lay down new definitions of *same ratio, greater ratio,* &c., and every proposition in the book that concerns proportion is vitiated.†

Again, Euclid has chosen to limit his proofs to figures which he can construct with rule and compass, for which two instruments he makes humble request in three postulates. The compass we willingly give him; concerning the ruler we demur, until he has shown how the straight line is generated. But all are aware that he might as reasonably ask for elliptic trammels or any other instrument, as for the ruler; in short, in constructing his figures, it is enough to show that his description of the figure contains nothing self-contradictory. His squeamishness here has entailed on him much disorder, besides the frequent introduction of petty problems,

* (Note by R. Simson on Euclid, V. 10.)--"It was necessary to give another demonstration of this proposition, because that which is in the Greek and Latin and other editions, is not legitimate: for the words *greater, the same,* or *equal, lesser,* have a quite different meaning when applied to magnitudes and ratios, as is plain from the fifth and seventh definitions of Book V." As usual, this editor makes sure that the error *could not* have been Euclid's own! *Theon* is generally the name on which he heaps the odium.

† R. Simson's additions at the end of this book are quite a literary curiosity. For ourselves, we cannot read the statement of Prop. K. with gravity. It contains the word *ratio* twenty-three times, as in school-boy days we remember to have counted. He says "they are frequently made use of by both ancient and modern geometers:" which we believe on his word; but what he called *modern* is not now modern.

most of which we could advantageously part with: some only should be turned into theorems, as in the fourth book. Further, in the employment of supraposition, he virtually uses another postulate, and when he approaches curvilinear areas, his system breaks down entirely. Thus, on Euclid xii. 2. R. Simson remarks, that to complete the proof we must insert: "For there is *some* square equal to the circle:" a thing true enough; but which rule and compass will never construct.

To do him justice, we must remember that he himself must have thought his fifth book unsatisfactory; for he treats ratios over again, and that numerically, in one of the books which we omit; and in another, he collects into a better order all the scattered properties of figures.

But further; in Euclid's day no doubt the second book was necessary to Geometry. At present it is highly ungeometrical and useless; because we at once discern, that out of the infinite number of algebraic developments, it selects a few to demonstrate geometrically. A sufficient substitute for these, is, to show (what at any rate needs to be shown) how the areas of rectangles are numerically represented, after making the square of the linear unit our unit of surface. The twelfth and thirteenth propositions of this book belong rather to Trigonometry or to Algebraic Geometry, than to this department; and the fourteenth is a problem misplaced.

What then is needed to make Euclid's Elements a logical, well-ordered, and perspicuous whole, confined to its proper limits, yet adapted to the existing state of mathematical science? Strange liberties have already been taken with it. The seventh, eighth, ninth, and tenth books, are sunk in the darkness of allusion: the lengths and breadths and depths and heights in the eleventh and twelfth are seen in shadowy distance; but the student is out of breath and comes to a halt, before he reaches the "method of exhaustion:" the fifth book is very frequently given him in grace, and an explanation of the fifth definition is thought enough. The second book will vanish of itself by a different arrangement, viz. by splitting the sixth in twain, and kneading it up with the first and third. The fourth book consists entirely of problems, most of which are to be wrenched out from all the books; twisting some into theorems, ramming down others into an Appendix, or book of exercises. A better distribution of various subjects is much needed. *Similarity of shape* should form a separate section, and a single definition be given of the word similar, applicable to figures plane or solid, curved or rectilinear. *Areas* equally need to be systematized. *Contact* and *curvature* in the circle should be so treated as to prepare the student for following out the subject with other curves; in short, according to the enlargement of view which the moderns have thereby gained. *Circular arcs* and *circular areas* need to have something said about them, and what is said, should be connected and compact. We have not noted how large changes in the first book may be required for proving the twelfth axiom: but, if attainable, we desire more method in exhibiting the proper-

ties of triangles of and parallels. After all, it must be remembered that something introductory is needed, (if not Mr. Thompson's thirty-nine pages,) before we can get our passport to land on Plane Geometry at all. And after the most necessary of these changes, how much of Euclid's twelve books will be left? We are therefore sorry to see men of original mind, like Mr. T. undertake the ungracious task of mending up an old and incommodious structure. It reminds us of the knife which had had three new blades, and two new handles: indeed his Intercalary Book is so startling a contrast to Euclid, that the old Grecian would justly complain of modern innovations, to say nothing of Prop. XXVIII. A, B, C, D, whose weight strains the threadbare substauce around them, threatening to make the rent worse.

F. W. Newman.

Nautical and Hydraulic Experiments, &c. By Col. Mark Beaufoy, F.R.S. 4*to.* 1834. *pp.* 688. *Vol. I.*

This volume is a record of a great number of experiments made by the late Col. Beaufoy, upon "the comparative resistances which different solids, constructed upon the same base and perpendicular, meet with in moving through a fluid." The results of the experiments are given in a convenient tabular form, the tables being arranged according to the face of the solid presented to the resistance. The fifth table is one of comparison with the former, the solids experimented with remaining of the same breadth, but of greater length.

The work is magnificently got up, and contains a large number of plates and diagrams. We have thought it right to mention its appearance now; but on account of the great practical importance of the experiments, we shall defer a regular analysis of its contents, until the appearance of the two remaining volumes shall enable us to include the whole in one view.

Manual of Mineralogy. By Robert Allan, Esq., F.R.S.E., &c. 8*vo. pp.* 351.

Mr. Allan is known to the scientific world as the possessor of a mineralogical collection, second only in importance to that of the British Museum, and collected during a long period by his late father, under whose superintendence the materials for the present volume were compiled.

The Introduction, which occupies about seventy pages of the work, commences with very brief observations on the crystalline forms of Minerals in general, considered according to the system of Mohs. The various physical properties of Minerals are then treated of in the following order; Specific Gravity, Hardness, Colour, Transparency, Lustre, Streak, Cleavage and Fracture, Double Refraction and Effect on Polarized Light, and the Parasitic (Pseudomorphous) formation of Minerals. The Introduction closes with the method of employing chemical tests and the blowpipe, in the analysis of mineral substances.

The "Arrangement," adopted by our author is, with some slight alteration, in accordance with that established by Mohs. The whole series is divided into nineteen "Orders."—1. Acid, 2. Salt, 3. Haloide, 4. Baryte, 5. Kerate, 6. Terene, 7. Malachite, 8. Mica, 9. Steatite, 10. Spar, 11. Gem, 12. Ore, 13. Metal, 14, Pyrites, 15, Glance, 16. Blende, 17. Sulphur, 18. Resin, 19. Coal. The sixth and ninth orders are new. In the former, the author includes Graphite, Chrysocolla, Allophane, &c. The ninth order is introduced for the purpose of grouping together Algamatolite, Serpentine, Killinite, and such others as the term Steatite suggests. We deem it right to inform our readers that this arrangement does not correspond with that of the minerals in the Bristol Institution, or of those in the British Museum.

Under the head of "Observations," appended to the scientific description of each mineral, Mr. Allan has furnished ample details of the localities, geological position, and varieties of each species; and the opportunity which he has had of inspecting various museums on the continent, has enabled him to convey highly interesting particulars on these points.

Descriptions of not fewer than ninety-two minerals are given in the appendix, which has been compiled with great care and judgment, from the scientific journals which have appeared during the last ten years, both in Europe and America. The valuable information herein contained, has rendered the work an indispensable requisite to the library of the experienced Mineralogist; and we strongly recommend the perusal of the "Manual of Mineralogy" to all who are pursuing the study of this interesting branch of natural science.

DOMESTIC OCCURRENCES.

LOCAL GEOLOGY AND ARCHÆOLOGY.

During the past year, some progress has been made towards a collection of specimens to illustrate the Geology of the great Bristol basin; the exact locality from which each has been obtained being marked upon a map, now constructing for the purpose, upon a very minute scale, and further particulars concerning the locality being entered in a proper index.

Hitherto those gentlemen whose lands have been geologized, have afforded the Geologists all the assistance in their power, in providing them with maps, local information, &c.; and great praise is also due to Messrs. Sturge and Townsend, the surveyors, for the very liberal manner in which they have furthered the views of the Institution committee. It is much to be wished that proprietors of coal mines and other subterranean works, would afford the same assistance towards the completion of an object so purely scientific.

The specimens selected are generally about a foot cube, and give a much

better idea of the general structure of the rock than could possibly be afforded by an ordinary hand specimen.

We feel great pleasure in stating, further, that the Geologists have determined to turn their attention also to the objects of antiquarian curiosity which in so wide a circle, will frequently be brought under their notice; we shall thus obtain a mass of information concerning the camps, barrows, castles, churches, ancient houses, &c. in the district, which cannot but be highly interesting, and which we propose, should this Journal succeed, from time to time to lay before its readers. We shall return to this subject towards the close of our Archæological essay—only observing at present, that descriptions of buildings, with sections of the arches, vaultings, buttresses, &c. are interesting to architects and men of general information, as well as to the antiquary.

SAURIAN REMAINS
IN THE
MAGNESIAN CONGLOMERATE OF BRISTOL.

Many of our readers are already aware of the above discovery—one of very considerable geological importance, inasmuch as it satisfactorily determines the identity of this particular formation with what have been considered as its analogues in other localities, but which differ materially from it and from each other, in general appearance and in mechanical composition. The Kuperschiefer and Zechstein, of Thuringia, the magnesian limestone of the north of England, and the above conglomerate, are the principal known representatives of this formation, which lies above the carboniferous series and below the red marle and lias. The beds of the Thuringewald and those of the north of England had been identified, independently of their geological position, by the fish and other remains discovered in each. This link had been hitherto imperfect with respect to the Conglomerate, probably from the disturbances which seem to have accompanied its deposition. The discovery of these Saurian bones has however at length completed it.

The fragments already found have belonged to, at the least, three Saurian animals, of two distinct species.

Of the larger animal have been detected *vertebræ*, many portions with their processes; the bodies of these vertebræ exhibiting the double concave system, thus resembling (though in this respect only) the Enalio-saurians and the crocodile of Honfleur. *Ribs*, of a flattened figure, and with marks of a double attachment. *Coracoid bones*, in figure rather resembling those of the true lizards than of the crocodile.

There are also portions of the *humerus*, *ulna*, and *radius*. The *femur*, *tibia*, *fibula*, and *chevron* bones. *Metacarpal* or *metatarsal* bones, *phalanges*, and *claws*.

Of the smaller animal have been found—a *dental* bone of the right side, about four inches long, and containing twenty teeth; these *teeth* are acute,

flattened, with the anterior edge curved and the point directed backwards; the posterior edge is incurved and serrated; the outline of each tooth somewhat resembling a surgical abcess lancet.

Of the *ribs*, two portions have been found of a rounded form, with a sulcus below for the intercostal vessels; also a small chevron bone.

The above notice is necessarily a very brief one, from the remains being imbedded in the solid brecciated limestone, and much mutilated; and Dr. Riley and Mr. Stutchbury, to whose exertions their preservation and identification is entirely due, have not yet had sufficient leisure to draw up a detailed account, which, moreover, when completed, will be transmitted, where it is justly due, to the Geological Society of London.

To the above account it may be added, that the bones were discovered in the quarry east of Durdham Down; several being in positive contact with, others one or two feet above the junction of the carboniferous limestone with the magnesian conglomerate. The boulders entering into the composition of the latter, are there of considerable size, angular, and without any appearance of having travelled far.

ICHTHYOLOGY.

During the autumn, this city was visited by the celebrated Ichthyologist, M. Agassiz, of Neufchâtel, (en Suisse,) who, upon the breaking up of the British Association at Edinburgh visited, in completing his tour, the collections of Dublin and Bristol. With the museum of the Institution he expressed himself much delighted, discovering there no less than thirty new species of fossil fish, many of them from the black rock, (carboniferous limestone). These specimens, together with several others from the well known collection of Mr. Cumberland, were, at M. A.'s request, liberally transmitted to London, to join the great congress of fishes now assembled at the rooms of the Geological Society. An artist is there at work upon them, and they will form illustrations of M. Agassiz's great work, entitled, "Histoire Naturelle des Poissons Fossilles," of which two splendid numbers have already appeared.

This work, which we shall notice at length when we receive the conclusion of the introduction, will contain descriptions and figures of one thousand species of fossil fish, of which upwards of two hundred are from Great Britain, and for the most part collected by the author during his late visit to this country.

In mentioning this work, we may express our hopes that the possessors of fossil fish throughout the country will forward the views of this distinguished naturalist, by placing their specimens, or fragments of specimens, under the temporary care of Mr. Lonsdale, at the apartments of the Geological Society; so that M. A. upon his return to this country in the spring, may have the means of employing his necessarily short stay to the greatest advantage. It was very gratifying to our feelings to hear M.

Agassiz make mention of the liberal manner in which the objects of his researches had been entrusted to him by the proprietors of the different collections which he had visited throughout the country.

For the information of the proprietors of local collections, we feel much pleasure in stating, that the curator of the Bristol Institution has kindly offered to take charge of any specimens which they may feel disposed to exhibit to M. Agassiz during his visit in the spring.

TIDE GUAGE.

In consequence of the suggestions of Professor Whewel, a Tide Guage was erected upon the Avon in 1833, by the Members of the Literary and Philosophical Society, and has now been in operation upwards of twelve months. The Guage is a self-registering one, constructed, with a few alterations, after the model of that invented by Mr. Palmer, and fitted up at the London Docks.

The spot selected for the observation is at Hungroad, near the mouth of the Avon, upon the estate of R. Bright, Esq. who has materially assisted the object by much personal attention; and is interesting as having been selected no less than one hundred and sixty years ago for a similar purpose, by Captain Sturmy, whose observations are recorded in the third volume of the Philosophical Transactions.

Since the erection of the machine, the result of its observations have been transmitted to and approved by M. Whewel, and a copy has also been deposited in the Hydrographer's office, Admiralty. We shall in future publish quarterly reports of the register, commencing with January, 1835.

SCIENTIFIC BOOKS PURCHASED BY THE BRISTOL INSTITUTION SINCE MICHAELMAS, 1834.

Lyell's Principles of Geology, 4 vols. 8vo. 1834.—Allan's Mineralogy, 8vo.—Conchological Illustrations, by G. B. Sowerby, Jun. 8vo.—Fossil Flora of Great Britain, Lindley and Hutton, 8vo.—System of Geology, Malte Brun, 8vo.—Philosophical Transactions.—Geological Transactions.—Transactions of the Royal Society of Edinburgh.—Transactions of the Cambridge Philosophical Society.—Edinburgh New Philosophical Journal.—London and Edinburgh Philosophical Magazine.—Repertory of Patent Inventions.—Zoological Journal.—Magazine of Natural History.—Mechanics' Magazine.—West of England Journal.—Naturalists' Library, 6 vols. 12mo.

FOREIGN WORKS.

Petrefacten von Dr. A. Goldfuss, folio.—Histoire Naturelle des Cephalopodes, M. le Baron de Ferrusac, folio.—Rccherches sur les Poissons fossiles, Dr. L. Agassiz, 4to.—Histoire des Vegetaux fossiles, Adolphe Brongiart, 4to.—Species générale des Coquilles vivantes, L. C. Kiener, 8vo.

FOREIGN PERIODICALS.

Memoires du Museum d'Histoire Naturelle de Paris.—Annales des Mines.—Annales de Chimie et de Physique.—Nouvelle Annales du Museum d'Histoire Naturelle de Paris.—Bulletin des Sciences.—Annales de Sciences Naturelle.—Revue Encyclopedique.

[The scite of the Bristol Institution, and the fact of its being closed on Sundays, rendering any meteorological or astronomical observations taken there both imperfect and incomplete, we avail ourselves gladly of the following "Observations," of the correctness of which our neighbours at least will entertain no doubt, when we state that they were made by Mr. E. Jones, of Small Street.—Ed.]

The Table for the present quarter, with the exception of the barometrical column as it now stands, having previously appeared, it may be necessary to explain that the barometer used for the tables already published, was situated about forty feet above the river, whilst the instrument now employed is one hundred and fifty, producing a difference of about 0·10 inch. in the mercurial column.

The temperature is noted by a pair of Rutherford's self-registering thermometers, placed outside a window, fifteen feet from the ground, with an open and unobstructed N. E. aspect. We notice this circumstance particularly, since a comparison with the tables now publishing in London, may lead to an impression that the thermometer used must have been kept in a sheltered situation, from the fact of the *minimum* temperature being so much higher than in London and its neighbourhood. We are warranted in assuming that the climate of this part of the kingdom is much milder than the vicinity of the metropolis, arising from its geographical position; whilst the same cause occasions a much greater quantity of rain to fall in this neighbourhood than in London. The difference is so great as to lead to a supposition that some error must have been committed, did we not know that the care and attention bestowed on this department here, and the character and ability of the registrars in London, render such a circumstance improbable. As an instance, we may mention that in January last, the quantity of rain which fell in Bristol measured 6·30 inch.; in London, the amount registered at the apartments of the Royal Society for the same month, was 0·345 inch. In February there fell in Bristol 2·19 inch.; and the Journal of the Royal Society states, that "during the present month, (February) the amount of rain appears to have been too small to become appreciable in the rain gauge employed."*

The Pluviometer, or rain gauge employed, is of the kind described by Howard in his "Climate of London," and was made by Bate of the Poultry. It is placed in a garden, at some distance from any building, and about eight inches from the ground. Its situation is N. E. of the city, in its immediate neighbourhood, and at an elevation of about one hundred and fifty feet above the river.

METEOROLOGICAL ACCOUNT FOR THE YEAR 1834.

	Barometer.		*Therm.*		*Rain.*	*No. of Days.*		*Winds.*								
Month.	Max.	Min.	Max.	Min.	Inch. and Decm.	Fair.	Rain.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Vrble.
January	30·30	28·92	56	30	6·30	3	28	1	0	1	4	1	14	9	1	0
February ..	30·42	29·67	56	27	2·19	7	21	0	2	2	3	4	7	9	0	1
March.....	30·49	29·65	60	25	1·19	20	11	1	8	1	2	1	6	11	1	0
April	30·46	29·24	67	29	0·93	24	6	1	16	4	2	1	1	0	3	2
May	30·44	29.38	80	37	0·88	23	8	0	8	0	1	5	10	5	1	1
June	30·33	29·60	84	40	2·79	16	14	1	2	0	1	4	12	5	3	2
July.....	30·23	29·55	84	47	6·26	12	19	2	10	0	0	2	10	1	1	5
August	30·15	29·56	84	42	3·65	13	18	4	4	0	1	4	10	5	1	2
September..	30·41	29·42	75	39	1·66	20	10	2	3	7	0	5	5	5	1	2
October	30·60	29·42	71	32	0·61	21	10	7	0	2	2	0	9	5	4	2
November..	30·42	29·27	62	29	2·96	19	11	2	9	5	0	2	7	4	0	1
December ..	30·58	29·39	58	29	0·88	24	7	6	6	2	2	3	4	5	2	1
Whole Year.	30·60	28·92	84	25	30·30	202	163	27	68	24	18	32	95	64	18	19

There has been no snow during the year.

* Since writing the above, we have seen the whole series of monthly tables for the year 1834, kept at the apartments of the Royal Society in London, by which it appears that the quantity of rain fallen differs so materially from that registered in Bristol, as to make a comparison highly interesting.

	PLUVIOMETER.	
	London.	*Bristol.*
1834.—Month.	Inch. Decim.	Inch. Decim.
January	0·345	6·30
February	None	2·19
March.....	0·306	1·19
April	0·025	0·93
May	0·430	0·88
June	0·927	2·79
July.....	3·364	6·26
August	1·688	3·65
September.....	0·582	1·66
October	0·185	0·61
November.....	0·035	2·96
December.....	0·114	0·88†
Total for the year.....	8·001	30·30

† The quantity which fell during December in the preceding year, was 8·93 inches. It therefore appears, that the quantity registered in London for the whole year, did not amount to so much as that which fell in Bristol in December, 1833.

METEOROLOGICAL TABLE,

For the months of OCTOBER, NOVEMBER, *and* DECEMBER, 1834, *kept on Nine-tree Hill, Kingsdown, Bristol.*

Oct.	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·99	61	44		E.	Fine
2	·91	67	46		S. E.	Ditto
3	30·03	68	48		E.	Ditto
4	·04	70	50		S. E.	Ditto
5	·01	71	55		Vrble	Ditto
6	·08	69	54		Vr le.	Ditto
7	·07	67	50		W.	Ditto
8	29·99	68	52	0·01	S. W.	Cloudy. Rain at night
9	·78	68	48	0·01	S. W.	Ditto Ditto
10	·87	60	34		N.	Fine
11	30·03	59	42		N.	Ditto
12	·01	65	48		S. W.	Ditto
13	·05	68	51		S. W.	Ditto
14	29·58	67	56	0·12	S. W.	Rain
15	·59	68	48	0·08	S. W.	Changeable
16	·49	58	42	0·06	S. W.	Ditto
17	·32	60	48	0·05	N. W.	Ditto
18	·60	58	42	0·04	N. W.	Ditto
19	·82	54	39	0·10	S. W.	Ditto
20	·58	62	47	0·11	S. W.	Rain, A.M. Fine, P.M.
21	·95	55	39		N.	Fair
22	·87	56	50		W.	Cloudy
23	·63	56	36	0·03	N. W.	Changeable
24	·77	55	37		N.	Fine
25	30·06	49	32		N.	Ditto
26	·27	49	35		N.	Ditto
27	·30	56	50		W.	Cloudy
28	·36	55	46		N. W.	Fair
29	·50	52	41		N.	Cloudy
30	·31	53	43		W.	Fine
31	·09	58	50		W.	Cloudy

Nov	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·99	59	46		W.	Fair
2	·96	57	35	0·08	S. W.	Cloudy. Rain, A. M.
3	·89	53	41		S. W.	Fine
4	·94	59	47		S. W.	Cloudy
5	·49	62	52	0·75	S. W.	Stormy
6	·50	62	54	0·32	S. W.	Fair. Rain, P. M.
7	·20	61	43	0·01	S.	Fair. Rain, A. M.
8	·29	52	41	0·30	S.	Fair. Rain at night
9	·36	45	39	0·35	N. E.	Rain
10	·78	43	33		N. E.	Cloudy. Rain, A. M.
11	30·08	45	35		N. E.	Fine
12	·16	41	31		N. E.	Cloudy
13	·17	39	29		N. E.	Fair
14	·32	44	31		N. E.	Fine
15	·29	47	36		N. E.	Cloudy
16	·27	49	40		N.	Ditto
17	·09	53	43		W.	Ditto
18	·03	50	35		N.	Ditto
19	·10	45	29		E.	Fine
20	29·86	38	32		N. E.	Ditto
21	·64	40	30	0·08	E.	Cloudy. Rain at night
22	·57	43	33	0·02	E.	Rain
23	·93	44	34		N. E.	Fair
24	·97	45	36		E.	Cloudy
25	·78	41	34		E.	Ditto
26	·75	40	30		Vrble.	Hazy
27	·87	47	40		S. W.	Fine
28	·57	49	41		S. W.	Cloudy. Rain at night
29	·17	50	39	0·50	W.	Changeable
30	·54	53	41	0·55	W.	Fine, A.M. Rain, P.M.

Dec	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·29	51	44	0·18	W.	Changeable
2	·59	51	40		W.	Fair
3	·98	54	43	0·02	W.	Fair. Rain, A. M.
4	30·01	53	47		S. W.	Fog
5	·02	51	42		S.	Fog. Fine, P. M.
6	·03	51	49		S. W.	Hazy. Rain at night
7	29·91	57	41	0·27	S. W.	Rain, A.M. Fine, P.M.
8	30·19	45	34	0·07	W.	Fine. Rain, A. M.
9	·42	46	34	0·17	S. W.	Fine. Rain at night
10	·22	45	29		N. W.	Fine
11	·47	44	29		N. E.	Dense Fog
12	·37	43	31		N. E.	Ditto
13	·30	44	31		E.	Hazy
14	·39	40	33		N. E.	Ditto
15	·45	45	39		N. E.	Ditto
16	·48	45	34		N. E.	Fine
17	·13	46	40		N.	Ditto
18	·24	45	37		N.	Ditto
19	·33	44	39		N.	Hazy
20	·28	43	37		N.	Ditto
21	·28	43	35		Vrble.	Fine. Aurora Borealis
22	·42	43	31		N.	Ditto
23	·41	42	32		W.	Ditto
24	·37	41	31		N. W.	Ditto
25	·28	44	35		N.	Hazy
26	·40	43	39		N. E.	Cloudy
27	·37	43	34		E.	Ditto
28	·23	42	33		S. E.	Fine
29	29·96	53	40	0·12	S. E.	Cloudy. Rain at night
30	·83	56	53		S.	Cloudy
31	·65	58	37	0·05	S.	Changeable

The mode of taking the observations is as follows:—The Barometer (with an open cistern) is noted every morning at nine o'clock, and its height placed opposite the day of the month; but the Thermometer and Pluviometer, which are also examined at the same time, have their results recorded opposite the date of the day preceding, consequently they apply to a period of twenty-four hours, beginning at nine, A. M. on the day indicated. The Wind is noted by observations on the highest and best vanes of the churches in the city; and when more than one direction is noticed during the day, the word Variable is used. The Weather noted is the general character of the day.

Small Street, Bristol.

EDWARD JONES.

ERRATA.

Page 2, line 18, for *reputed* read *repeated.*
„ 3, line 9, for *the* read *their.*
„ 4, line 36, for *their* insert *the peculiar forms of this.*
„ 5, line 3, for *tions* read *tives.*
„ 5, line 36, for *plearonestec* read *pleuronectes.*
„ 6, line 20, for *il* read *lil.*
„ 6, last line but two, for *here belong* read *have belonged.*
„ 8, line 18, dele *and.*
„ 8, line 22, for *; of* read *all ;* and after *members* insert *;.*
„ 9, line 20, for *Ei* read *O.*
„ 9, line 33, for *literal* read *littoral.*
„ 15, line 13, for *with* read *rocky.*
„ 16, line 13, after *construct* insert *a world.*
„ 22, line 28, for *necessarily* read *incessantly.*
„ 23, line 31, for *carnivorous* read carnivorous.
„ 25, line 7, for *ten* read *one.*
„ 41, line 14, for *bivalve* read *univalve.*
„ 3, lines 11 and 18 for *Œ* read *Æ.*

The present number should have appeared fourteen days ago; the hurry and business of a contested Election must be our apology for a delay which will not, we trust, occur again.

It will be obvious to any person acquainted with the usual expenses of printing and publishing, or who compares our Journal with others of a similar price, that the size of the present Number is above that which we can usually be expected to give. The size of each Number will probably be about 7 sheets—112 pages, but this, and the number of our wood cuts, must of course depend upon the extent of our circulation.

and direction, when we reflect upon the inferences which naturally flow from what we are thus constrained to admit as to the origin of the fair order we survey, including a physical structure of the earth's surface, so admirably calculated to supply all the wants, and to gratify the senses of its inhabitants; and that often, as especially in what may be called the hydraulic systems of the globe, that is, in every thing connected with the origin of its springs, and the distribution of its streams, by a regularly adjusted series of mechanical contrivances: when we reflect, I say, that all this fair and most beneficial order has originated amidst scenes of the wildest wreck and violence, we may surely be led to look up with a deeper conviction to the interference of a controlling and intelligent cause, "*riding on the whirlwind and directing the storm,*" and making the most furious energies of nature work out his own purposes of benevolence. Although we may, indeed, perceive equally convincing proofs of this First Cause, in all the ordinary and regulated processes of nature, yet we are but too apt to lose sight of it, while tracing that constant sequence of cause and effect, which is in truth but the result of its own unremitting and immutable energy. It is, therefore, more forcibly brought home to our feelings and imaginations, when our attention is called to those critical periods of nature, which called for its interference rather as a controlling than sustaining power.

Saussure has very forcibly expressed the impressions which the view from the summit of Buet thus impressed on his mind:—"It excites," says he, "the most profound emotion in the soul, and opens to the philosopher the widest field of thought; for, without arresting our thoughts, when we have surveyed the glaciers and snowy summits, and contemplated the sweet assurance which they afford of the perpetuity of the rivers which flow from these sources, if we further reflect on the formation of these mountains, on their age, on their succession, on the causes which have been able to accumulate these stony elements at so great an height above the rest of the surface of the globe; if we investigate the origin of these elements, if we consider the revolutions which they have already undergone, and those which may still await them, what an ocean of thought! Those only who have given themselves up to such meditations on the summits of the loftiest Alps, can appreciate how much more profound, more extensive, and more luminous their views become, than any which they can obtain while enclosed within the walls of their cabinets." We cannot, indeed, lead our home readers to those peaks of the "Hautes Alpes," but it will be our object to shew them, that the prospects from our humbler hills, although they cannot, indeed, compete with these in picturesque sublimity, may yet fully rival them in the philosophical interest of the features which they unfold to our eyes. We shall esteem ourselves happy if we can thus open to our readers novel and abundant sources of interest and instruction, in their daily walks through the scenery of a neighbourhood not more distinguished by its well

known picturesque beauty, than by its geological variety and importance. With reference to the topics of information always presenting themselves to an intelligent mind in the course of such walks, we remember in our youth to have read a very excellent story of Miss Aikin's, entitled, "Eyes and no Eyes." Now eyes are especially requisite in geological investigation; and it will be our aim to furnish our friends with geological spectacles to assist their vision.

For a general view of our district, we will first volunteer our services as guides, to attend the reader in his walks to the summit of our own Dundry Hill, and point out to him the geological features he will thence survey. We may boldly say, that there is no other station in Europe, not excepting even Saussure's Buet, which brings into view so rich a variety of formations, including so nearly the whole series of rocks, from the oldest transition to the newest secondary—from grauwacke slate to chalk. A single glance at this view will at once convince the observer of the great advantages which Bristol offers as a central spot, for the residence of a geological enquirer; and if a geologist should imitate the example of one of our most active and intelligent professors, Buckland, and give his class an occasional field lecture, (the very best of lectures,) he could not possibly desire a better station than is thus presented within three short miles of our city.

If from the summit of this hill, the observer looks to the south-west, he will see the transition line of the Quantoc hills, skirting the horizon, behind the Mendips, and appearing through the openings of the nearer chain; and beyond the western extremity of the Mendips, he may observe the prolongations of the transition ranges of Exmoor forest, lining the Channel on the south, and swelling into hills which may almost claim the dignity of being called mountains.

The Quantoc hills, which are within twenty-five miles of Dundry, consist of transition slate and transition limestone, at Nether Stowey, which will afford our friends, if they are inclined to extend their excursion, a rich harvest of characteristic specimens of all the organic remains of that formation; the veins of copper ore traversing the limestone, will also supply very beautiful malachites. As these hills also, at Hestercombe, exhibit a small protruding mass of granite, we have an example of this very important rock also within thirty miles.

Calling our eyes back nearer home, the long line of the Mendips stretch before us, on the other side of an intermediate valley of about seven miles; the highest points of this chain consist of arched strata of old red sandstone,* which have been, by some mighty elevating power, forced through the investing mantle of carboniferous limestone, forming the flanks and lower portions of this range of hills. The strata of this latter rock are

* The formation of old red sandstone may be well studied on the left bank of the Avon, opposite Cook's Folly, where it emerges from beneath the limestone.

generally thrown up at a very high angle, and often nearly vertical: and it is traversed by precipitous ravines of the very boldest character, so that we cannot desire a better opportunity of studying the phænomena of elevation, or examining the rents which appear to have been occasioned by these disturbing forces. The features of Cheddar Cliffs are not often exceeded in magnificence, even in far more mountainous countries. If we carry our eyes from south-west towards the north-west, we still observe detached hills of the same carboniferous limestone, combining to form the boundary of the great coal basin (as such depressions of the strata are technically termed) of North Somerset and South Gloucester. The first of these, Broadfield Down, abounds, like the Mendips, in fine ravines. Brockley and Cleeve Combes will equally repay the geologist or artist who may visit them. The features of the nearer ranges of Leigh and Durdham Downs must be familiar to every Bristolian; and every one must be well acquainted with the abrupt defile opening between them, as it were, on purpose to afford an outlet to the Avon, which, were this breach closed, would cover all Bristol, except St. Michael's hill, and all the low grounds between this and the Kingswood hills, and convert them into an extended lake. This defile is no less geologically interesting than picturesquely beautiful, and presents very instructive examples of compound fractures, as they may be called, of the rocks. We shall hope to give a full description of this ravine in a future number, as it will afford our readers the most illustrative geological walk, and that close to their own doors; but the subject would require graphic illustration, and for the present we must content ourselves with saying, that it will be found to afford the best examples of all that has been said in our general outline, with regard to faults and dislocations.

We should next call our observer's attention to the points in our geological panorama connected with the history of the coal measures, or strata immediately alternating with the coal. Behind the Hotwell House will be seen a bed of shale, immediately reposing on the carboniferous limestone, and containing the lowest trace of coal; but it is a mere trace, and is separated from the principal deposit by a thick mass of compact quartzose grit; this exhibits itself at Brandon Hill, and the hills above Ashton Park. At the foot of these hills succeeds a great thickness of argillaceous shale, containing the principal coal seams; these are very generally covered up in our district by more recent and nearly horizontal overlying deposits, as they are called, of red marl and lias; but the coal has been worked by pits, sunk through this cover, as may be seen a little below our station, in the Bedminster collieries. This argillaceous series is succeeded by a thick deposit of coarse sandstone, abounding in specks of coal, and often presenting vegetable remains; this sandstone rises into low hills, in the coal fields of Kingswood and Coalpit Heath, which are separated from one another by a great undulation of the strata, or anticlinal line. The ravine through

which the Avon flows, between Keynsham and Pile Marsh, traverses this sandstone and presents very good sections of it. On the north of the Avon, the coal strata are generally exposed on the surface of the ground, throughout our coal basin, which in that direction extends as far as Cromehall; here the margin of carboniferous lime bends round it, then turning southwards by Wickwar and Chipping Sodbury. But near the latter town, the superior deposits of red marl and lias overflow, as it were, into the coal basin,* and cover the strata composing it. These newer deposits extend as they advance to the south-west, so as to overlay and conceal almost the whole of the basin between the Avon and the Mendips. This occasions the pits in this district to be often sunk to a great depth, before the true coal measures are touched; at Clandown, for instance, a shaft was sunk through the whole thickness of the lias and red marl, more than one hundred fathoms; the total depth at which it is now worked being near two hundred. Such a statement as this would in most other coal districts be rejected as incredible. The coal measures are, however, stript of this covering, or, to use the technical word, denuded, in the vale of Pensford, lying at our feet on the south-east, as we stand on Dundry, and again at Nettlebridge, close to the north-eastern extremity of the Mendips. We have here the best opportunities of studying the phænomena of vallies of excavation, as explained in our former outline, p. 15. The collieries about Nettlebridge also strikingly exhibit the disturbances which have been produced by the elevation of the Mendip Hills; the strata are often quite vertical, sometimes thrown quite over through an angle exceeding 90°, and commonly very greatly contorted, being twisted in the shape of a Z, &c.

We should next direct the attention of our observer to the phænomena of the more recent overlying rocks before mentioned, as exhibited in the district now beneath our eyes; and the very first we have to examine will forcibly illustrate some of the most important points in our general outline. The violent convulsions which elevated the Mendips, and shattered and contorted, in the manner we have just noticed, all the adjacent strata, must necessarily have occasioned vast masses of torn and fractured rocks; and as the ocean appears, from the nature of the subsequent and overspreading deposits, to have still covered all this district at the period in question, these submarine explosions and movements must have produced the most violent waves and currents. By these means, the piles of wrecks to which we have alluded, would have been drifted asunder, and distributed in the form of a broad sheet of shingle, over the general surface; this mass being of course thickest towards the base of the hills by whose elevation it was occasioned, and from the ruins of whose strata it was derived. Now we

* In the romantic defile of Wick rocks, however, the carboniferous limestone again, for a short interval, emerges from beneath this deposit.

shall find the actual state of things exactly that which we should thus, *à priori*, have anticipated that it must be—a vast bed of shingle, composed principally of fragments of carboniferous limestone, in blocks of various sizes, from masses of two tons to lumps no bigger than a nutshell, and commonly more or less water-worn, forms the first horizontal covering, overspreading the general surface of the highly-inclined coal strata, the broken edges of which appear to have been first worn smooth, and as it were planed down, by the action of the violent currents to which we have alluded. This shingle bed is, near the Mendips, about a hundred feet thick, but grows thinner as we recede from them. This shingle has become consolidated by the earliest deposits of the pœcilitic or variegated marls, into an hard calcareous conglomerate;* as magnesia abounds in it, it is usually (from the mineralogical name for magnesian limestone,) called the dolomitic conglomerate. This rock often forms a very tolerable brecciated marble, and as such, has been used in the pillars of Wells cathedral. It may be well studied along the north brow of the Nettlebridge valley, at the north-east end of the Mendips, where its horizontal strata will be seen forming a thick cap, covering the inclined coal strata; as this shingle bed would naturally rest indifferently on any older rock which came in its way, we see similar beds on Durdham Down, resting on the mountain lime; they may be examined very advantageously in walking along the new road winding up the Down, from the west foot of St. Vincent's rocks; we shall here be especially struck by the vast size of the blocks in the lowest beds, but find them diminishing, till reduced to small grains in the upper beds. All along the valley of the brook called the Trym, between the opposite ranges of Durdham Down, where the carboniferous limestone dips east, and Kingsweston Down, where the same rock dips west, we find the dolomitic conglomerate resting, at Sneyd Park, &c. on the subjacent old red sandstone, which must here have an arched, or anticlinal stratification. The junction of the horizontal and inclined strata is very strikingly displayed in a cliff on the south side of the Avon, opposite Sneyd Park. The pœcilitic, or variegated sandstone, or rather marl, (for only some of the lower beds consist of sandstone,) forms the deposit immediately succeeding to the shingle bed, or conglomerate just described; in our district it does not exceed two or three hundred feet in thickness, but in the midland counties must be seven or eight times as much. It presents no organic remains, but abounds in sulphate of lime, (gypsum,) and sulphate of strontian, (celestine); both occur abundantly at Aust Cliff, near the Old Passage, where the formation may be well studied. Celestine also occurs

* In some places this shingle bed seems not to have come in contact with the planes of the pœcilitic deposits, but with those of the superincumbent lias; in these instances, a singular conglomerate of carboniferous lime, cemented by lias, occurs. This especially prevails about West Harrington, along the south slope of the Mendips, between Wells and Shepton Mallet.

in great quantity near Bitton. The variegated character which gives name to the pœcilite, is well exhibited in the new cut of the river at Bristol, which is excavated in this rock.

The next deposit of Lias, an argillaceous limestone, which rests on the pœcilite, spreads over the whole of the lower, but still somewhat elevated platform which forms the base of Dundry Hill; and occupies all the grounds of middle elevation from hence to Bath, the valleys being occasionally excavated into the subjacent pœcilite, and the hills formed by the superincumbent oolite. The organic remains of the lias are very abundant and interesting; and we shall be struck by trampling, at every step, on its ammonites, gryphites, and plagiostomæ. A very perfect skeleton of the plesiosaurus has been found at Bitton. We need not here repeat what we have said in the introductory notice of the last number, with respect to the distinction between the older order of organic remains of the carboniferous limestone, &c., and the secondary fossils of the lias and oolites; but our walk up to Dundry may afford us an opportunity of illustrating this in a very striking manner. When, from the pœcilite of the valley, we first ascend the lias platform, a little beyond Bedminster, we are only separated by the narrow valley of the Ashton brook, from the carboniferous lime of Leigh Down. If we cross this valley for a few minutes, we shall find the carboniferous lime, often a mere aggregate of thousands of encrinites, madrepores, and peculiar shells; and on the lias platform, on the other side this narrow valley, we shall find an equal abundance of pentacrinites, gryphites, ammonites, and other shells; but we shall in no instance find a single species common to the two rocks, though here scarcely half a mile apart. This shews us, that geographical proximity can have nothing to do with the orderly distribution of organic remains; and we shall be impressed with the truth of the dependance of this order of distribution, on the geological succession of beds, if we compare our two parcels of carboniferous limestone and lias fossils, with others from the most remote localities. The former, if compared with collections from Derbyshire, Kilkenny, or the banks of the Meuse, will be found identical; as will the latter, if placed by the side of specimens from Lyme Regis in Dorsetshire, the lowest beds of the Whitby coast in Yorkshire, from Boll in Wurtemberg, from many parts of the Jura chain, &c.

The deposit next succeeding to the lias, is that of the calcareous freestone, called oolite, or roe stone, from its granular concretionary texture somewhat resembling the roes of female fishes. These deposits constitute the mass of a long range of hills, stretching across the island from Yorkshire on the N. E., to Dorset on the S. W. From Dundry we may observe a long chain of this range, here called the Cotteswolds, stretching away from Frome, on the south by Bath, towards the neighbourhood of Gloucester and Chippenham, on the north. This chain presents a steep escarpment towards the west; it often approaches, and sometimes exceeds, a thousand

feet above the level of the sea in height, and is deeply intersected by valleys of excavation. All the phænomena of this kind, mentioned in our introductory outline, p. 15, may be well studied in the valleys around Bath. In Dundry Hill itself, we have a good example of what is meant by an insulated outlier, (see the wood-cut in the place referred to); it presents us with the lower beds of the oolite formation, which are of a coarser texture, spotted with oxide of iron, and separated from the lias by beds of calcareous sand: the quarries of Dundry will afford us a rich harvest of the organic remains of this formation. The oolite is subdivided into many subordinate beds, but it would only give rise to confusion to specify them all in this place; we need only at present attend to one of the principal of them. The Bath oolite and its upper bed, called the cornbrash, sinks beneath a thick clay, not unlike much of the lias formation along the line from Melksham to Chippenham. In some stony beds associated with this clay, at Kelloways, abundance of some peculiar species of ammonites are found. Further west, rises the ridge of middle oolites, and ranges by Steeple Ashton, Bow Wood, and Calne; this is also called, from the abundance of madepores which it contains, the coral rag, and offers the exact antitype of one of the coral reefs of the Pacific, so fully described by Mr. Stuchbury in our last number; as he informs us that corals do not extend to a depth of many fathoms beneath the surface, this would afford us a datum for estimating the depth of the ocean at the period when the coral rag was formed. This subject seems to us to be pregnant with the most important inferences, and has not, we believe, been hitherto attended to by geologists; since many of the later marine deposits, the chalk for instance, tower high above the coral rag. If the latter must indeed have been at the time of its formation so nearly superficial, the crust of the earth must have subsequently been greatly depressed before the chalk could have been deposited; but as the general movement was assuredly that of successive elevations of the said crust, our argument would seem to imply very material oscillations.

The still more recent deposit of the green sand, as it is called, (from the specks of chloritic earth intermingled with it) sweeps over the coral rag south of Steeple Ashton, and advances by Warminster to the long ridge above Stourhead, crowned by Alfred's tower, a very conspicuous object in our panorama from Dundry. The organic remains which may be found about Warminster, are abundant, interesting, and peculiarly characteristic of this formation, especially the numerous varieties of fossil alcyonia and sponges. The western extremity of the chalk downs of Wiltshire, may be seen towering above this ridge of green sand, in the hills above Maiden Bradley and Mere, marked objects in our view from Dundry, and within twenty miles. At these points we may obtain all the chalk fossils; so that we have surveyed every formation, from grauwacke to chalk, in a panorama of less than thirty miles radius from Dundry as a central point;

and these formations constitute the whole of the geological series, excepting mica slate and gneiss, among the primitive rocks; (granite, as we have said, does shew itself in the Quantocs;) and England presents us with no decided examples of what is here wanting, the nearest point where we can examine them being the Scotch Grampians. At the other extremity of the series, we do not indeed find the tertiary formations within our circle; for these we must go to the coasts of Hampshire and the Isle of Wight. Although there is another important class of rocks we have not yet noticed, namely, the intruded masses of trap rock, of supposed igneous origin, yet dykes of this description occur within our thirty miles circle, at Tortworth, beyond the northern border of our coal field; they there traverse the old red sandstone, and subjacent transition limestone, which there emerges. Their phænomena may therefore also be studied within our field: and this particular locality most strongly illustrates the multum in parvo which generally characterises our district, as we have here these intrusive rocks, and the whole series of regular formations, from transition limestone, to the oolites of Wotton-Under-Edge inclusive, brought within the astonishingly narrow compass of about three miles.

We have thus endeavoured, from our most commanding station, to point out to our readers the very wide and interesting field of geological research, spread before their feet, and continually inviting their examination; and this, as we have said, must be ever by far the most efficient, as well as the most interesting and delightful, school of Geology. Still we must not forget, that the alphabet of our science, the knowledge which will enable a person to tell one species of minerals and organic remains from another, must first have been acquired elsewhere, (in cabinets and museums) before our observer can be adequately prepared to profit by his actual examination of nature; and that examination will be rendered doubly profitable, if he has the opportunity of consulting, from time to time, copious and well-arranged collections, and comparing with them the specimens he may himself have succeeded in procuring. Now we believe we may boldly say, that no other provincial institution is at this moment so richly furnished, as that of Bristol; and we know that one of the most active and intelligent continental naturalists of the day, M. Agassiz, warmly expressed himself to the same effect, when he visited Bristol, towards the close of a very extensive tour of inspection, through most of the towns in our island, which possess such institutions, for the purpose of availing himself of any resources which they might offer to assist him in the prosecution of his great work, the History of Fossil Ichthyology. We shall briefly, therefore, state the general nature and extent of our collections bearing on the present subject: and it is one of the points in which we flatter ourselves that our efforts may render the most essential benefits to the interests of science in Bristol, if by statements, like that on which we are now about to enter, we shall succeed in ren-

dering its inhabitants more generally acquainted with the stores of this description which they possess, and thus rendering those stores more available to the great purposes of general information for which they are formed.

To begin with our cabinet of minerals: this, which was originally purchased from Mr. Blisset in 1824, and has since received additions, is quite sufficiently extensive to be fully adequate to every purpose, as a general collection; the specimens, moreover, are remarkably good and characteristic. Those who have made Crystallography, the most scientific branch of mineralogy, their study, have expressed themselves much satisfied with what we possess, illustrative of this department. The cabinet contains above two thousand specimens, which are arranged according to the classification of Mr. Phillips, and entered in catalogues open to the visitants, for the purpose of reference. The well-used state of these catalogues sufficiently attests, that our residents have become fully aware of the utility of this portion of our museum.

Our geological stores, although in truth very superior to the former, and we believe quite unrivalled out of the metropolis, are not nearly so well known, because, from the deficiency of cabinets, it has hitherto been impossible to arrange them; but this deficiency is now in the course of removal; and we trust, that before the first annual volume of this journal is closed, matters will wear a very different aspect. Most proud shall we be, if our humble efforts can in any manner assist in promoting so desirable a consummation.

We shall at present describe our general stores, first stating, however, that (what must be always of very primary importance in every local institution) a collection of specimens intended to illustrate the local Geology, and thus most effectually to assist and direct our visitants in their examination of that district, is now in the course of formation.

As fossil Zoology has long been the basis of scientific Geology, we may sufficiently indicate the extent of our collections, by shortly noticing the specimens which we possess illustrative of the organic remains of the several formations, beginning with the lowest fossiliferous strata. Of the transition limestone fossils, we have a very fair collection presented by Dr. Cook, of Tortworth.

In our series of carboniferous limestone, the collection of encrinites, (formed by our late curator, Mr. Müller) is well known to be unrivalled. It contains the original materials of that important work, which De Blainville, one of the most zealous zoologists of France, has recently mentioned, (in his Actinologia) together with that of Goldfuss, as the only two works published by geologists, exact enough to throw much light on any of the races of Zoophytes. M. Agassiz stated, that he found our ichthyological remains, from this formation, more ample than any he had elsewhere seen; they are at present, together with those belonging to many other of

our provincial institutions, in London, for the purpose of being rendered, by his artist, available to the illustration of his great work. It is truly gratifying thus to partake in that liberal interchange of information, which binds together the men of science of every land: in no other way can our institutions more effectually promote the great objects for which they were called into existence.

Our collection of the vegetable remains of our coal field is good. The magnesian conglomerate of our district was, till lately, supposed to be destitute of organic remains; but the very interesting discovery of saurian bones in this formation, has now materially enriched our collection.

In the lias fossils we are very rich; and our illustrations of its extinct saurians, (its most interesting feature) are quite complete. We have two of the finest specimens of ichthyosaurus which have yet been found at Lyme, 1. the I. Communis, and 2. the I. Tenuirostris; and we have casts of the two species of plesiosaurus, which, for any purpose of information, are quite as good as the originals. In the Ichthyology of the lias, we have a splendid specimen of the trigonolepis; and another species, described by Dr. Riley as intermediate between squalus and raia, but possessing most decidedly the characters of the latter; this M. Agassiz pronounced to be unique, and one of the most interesting specimens he had seen. It will be still more valued by those who know, that the institution owes it to the unfailing liberality of its most zealous vice-president, J. N. Sanders. Our lias shells and pentacrinites are numerous and excellent.

With reference to the oolites, our collection of specimens from the inferior oolite of Dundry, is probably one of the best in the kingdom; and the great oolite of Ancliffe, near Bradford, has furnished us with a collection of minute shells, of very great interest and beauty. Our collections from the Cornbrash, Kelloway rock, coral rag, and Portland oolite, are also very good.

From the greensand, (especially from Blackdown) our collections are believed to be the richest in the island. Dr. Fitton, who has long been preparing a monograph on this formation, has drawn a very material portion of his illustrations from this source. We have also a large collection of alcyonia, &c. from Warminster, for which we are indebted to the science and liberality of a lady, Miss Bennet.

The chalk is the most deficient part of our collection. Let us hope, that to make known a deficiency, will be the most effectual way of removing it.

Our series of tertiary specimens is also very fair. Dr. Laird, through our constant friend, the proprietor of Hampne Green, supplied us with a very complete suite from the London clay of Bognor. We have been also well supplied from the celebrated cliffs of the Hampshire coast, and from the interesting fresh-water deposits of the Isle of Wight: from thence we have a cast of

some bones of the anoplotherium, an extinct quadruped, the original having been presented, by Mr. Pratt, to the Bath Museum. We have a very fair series also from the basin of Paris. And of the most recent of the tertiaries, (Lyell's Pleiocene), we have some interesting specimens, collected by Dr. Daubeny, in Sicily; and a very complete Sub-appenine series, from Sienna, for which we have a second time to express our obligations to a lady, Miss Rowe.

When it is considered that all this has been effected in little more than ten years, it cannot but enhance our views of the efficiency of the principles on which our institution has been founded; but assuredly the collections themselves need no such apology to recommend them.*

In addition to this public collection, many of the private cabinets of Bristol deserve particular notice, especially those of Messrs. Johnson and Cumberland; the former is particularly distinguished, by the truly gigantic ichthyosaurian specimens which it contains. In the Bristol Library is a small collection, formed almost a century back by the Rev. Mr. Catcott, the author of a Theologico-Geological Treatise on the Deluge: he belonged to the Hutchinsonian school—very fanciful in many respects—but which yet gave rise to many very good observations on the phænomena of valleys of excavation. Mr. Catcott was particularly distinguished in this respect; he was also the first discoverer of the ossiferous caverns of the Mendips—indeed the first English author who opened the subject, which Dr. Buckland has since rendered so popular. His collection in the library contains some interesting specimens of the bones of fossil elephants, &c. from the Hutton caves.

The sister institution of Bath, also possesses a very instructive, though far less copious geological collection. The zealous interest of Mr. Pratt cannot fail to render it daily more valuable. In some of our lesser towns also, institutions on a smaller scale are rising; we have especial pleasure in noticing one such, recently established at Devizes. It has already acquired a good collection of the organic remains of the neighbourhood, from the liberality of Mr. Salmon.

* To such of our readers as attended the course of geological lectures, delivered during the last summer, by Mr. Worsley, for the benefit of the institution, many of the stores which we have been enumerating, are more or less familiar. The great advantage of such collections in general, as well as the efficiency of our own, in particular, have rarely been more strikingly made manifest, than when brought forward in illustration of a course of lectures, among the ablest, most complete, and nevertheless most popular, of any yet delivered within the walls of the Bristol Institution.

AN INTRODUCTION TO ZOOLOGY,

IN ILLUSTRATION OF THE ZOOLOGICAL DEPARTMENT OF THE MUSEUM OF THE BRISTOL INSTITUTION.

(Concluded from p. 44.)

In the present article we propose to ourselves two objects; first to exhibit to our readers a general view, drawn up in the form of Synoptical Tables of the principal facts connected with the Physiology of the several animal functions, as these vary in the various classes of the animal kingdom, calculated to illustrate and to bring more conveniently beneath the eye, the points we have already endeavoured to explain in the introductory memoir on Zoology in our former number. And secondly, to point out, as an object of very important local interest, the means which the museum attached to the Bristol Institution, affords to the inhabitants of that neighbourhood, of studying the subject, as alone it can be studied effectually, by the examination of actual specimens.

With regard to the first object, our Synoptical Tables, they will, it is trusted, speak sufficiently for themselves. In these tables, the names of the principal classes of the animal kingdom occupy the first column, and the succeeding columns are devoted to the several functions:—1. Digestion; 2. Absorption of Chyle; 3. Aeration of the blood; 4. Circulation throughout the system; 5. Muscles and Organs of Motion; 6. Nervous System and Senses; 7. Reproduction; so disposed, that the great principles concerning the physiology and organs of these functions in each class of animals will be found in its proper column, and horizontally opposite to the class of animals in question. All who have ever been accustomed to study any complicated subject, where it is important that a well-arranged comparative view of the facts to be examined should be present to the mind, must be well aware how powerfully, by the use of such tables, the eye is made to assist the mental faculties; facilitating in the first place the exercise of its powers of apprehension, and then aiding those of memory, in treasuring up the truths thus brought before them, with all the advantages of a systematic method, which, to be understood, needs only to be inspected. It is obvious also, that if at any time the memory requires to be refreshed, the form adopted in these tables will best subserve the purposes of instantaneous reference. In these tables, then, we hope we shall afford to such of our readers as may be inclined to pursue the study of Zoology, a very useful subsidiary compendium, such as may materially assist them in following with more profit any larger work which they may peruse, or any course of lectures which they may attend (and many such, and of very high interest and value, have been delivered in the theatre of our institution, especially those of Dr. Riley). We may here also add,

that in drawing up the very abridged and compendious view contained in our last number, the same was our leading object. We are well aware, that whenever it becomes necessary to aim at extreme condensation, such as would endeavour to comprise the substance of whole courses of lectures or voluminous works in a single essay of a few pages, dryness very generally, and not seldom also, according to the often-quoted line of Horace, obscurity must be the result; still there are undoubtedly great advantages in thus presenting at once to the mind general views of the whole subject, conceived in the fewest possible words. And we would trust that the more detailed essays which we hope hereafter from time to time to lay before our readers, on the separate branches of Zoology, will be rendered much more conducive to the intelligent and scientific acquisition of this most interesting department of knowledge, when properly referred to the general principles we have thus endeavonred to inculcate.

In seeking to point out to our readers, which was our second object, the Zoological stores which our very excellent institution offers for their instruction, we shall pursue a method similar to that which has been applied in the preceding article to our Mineralogical and Geological collections. Under each of the leading classes of the animal kingdom, we shall say a few words concerning the materials for its illustration, which are thus placed at the command of the public.

1. We may begin, then, with the class of Zoophytes, to which, from their radiated structure, the name actinozoa has been given, and the branch of Zoology which treats of these, denominated Actinology, in one of the latest and ablest works on the subject, by M. de Blainville, to which we would especially wish to refer those of our readers who may desire to acquire a full and comprehensive acquaintance with the organization and physiology of this class—a class which, though it be indeed the lowest in the animal kingdom, is yet singularly interesting, from the beauty of the forms it often exhibits, and still more so from the novel light which it is calculated to throw upon what may be called the metaphysics of the vital principle, by presenting us with the remarkable phænomena of compound animals, each member of which apparently possesses a perfect and distinct system of its own, while they are combined together into a common living system, just as are the individual branches and flowers of a single plant. We hope hereafter to return to the more detailed consideration of this subject; at present we have only to notice the specimens which our museum affords in its illustration. And here we have the gratification of stating, that these present every requisite advantage for studying the general history of the beautiful and interesting class of corals. The collection of flexible corals is peculiarly rich; and although that of madrepores is somewhat less so, still is it, on the whole, very satisfactory. Of the naked polypi, or actiniæ, also, there are some specimens preserved in spirits, which will enable the student better to examine the interior organization of animals of the same

class as those which inhabit the cells of these curious receptacles; for, without a knowledge of the animals, to mistake the having learnt the figures and names of their receptacles for the acquisition of a science, is as absurd as it would be to form a collection of birds' nests, and then to imagine that ornithology might be thus mastered. It will be interesting to compare these recent madrepores with the fossil species in our geological collection.

2. The acalephæ medusæ, or jelly fish, naturally form the next order to the actiniæ; of these we have several very good specimens, preserved in spirits.*

3. Of the radiated echinodermata, including sea urchins, star fish, &c. our collections are very fair.

4. The naked ascidiæ, though of a much higher organization, and closely approximating to the acephalous mollusca of the bivalve shells, still often present the same singular phænomena of many individuals combined together in a common living mass, as we have before noticed in the actiniform polypi of the corals. We shall hope hereafter to call our reader's attention more particularly to these animals; our museum at present possesses only some specimens of the simple species, viz. biphori, preserved in spirits.

5. In ascending the animal scale, we must next advert to the mollusca, or soft inhabitants of bivalve and univalve shells. And here we have again to notice, that many, attracted by their beauty, have formed large collections of the dead shells, which were merely the covering of these animals, and having learnt their forms and Linnean nomenclature, have fondly fancied that they had gained real scientific knowledge. Every English manual of Conchology must, we fear, be included in this censure. But here again we are happy to refer our readers who wish to acquire that knowledge of the physiology and organization of the animals, which alone really deserves the name of natural science, to the recent work of De Blainville, entitled, "Malacologie," where all the materials will be found thrown together in a very luminous, interesting, and masterly manner. We are happy to say, that our collection is not only very complete as to the shells, containing about three thousand species; but that we also possess, through the zeal and ability of our curator, among our preparations in spirits, several very illustrative specimens of the molluscous inhabitants, exhibiting especially those which are most characteristic of their peculiar types of animal organization.

6. Of Entomology we possess the foundation of a good collection; but we have to regret that it is not as yet arranged.

* In all these departments, our stores have been much increased by the kind liberality of many captains of our port, who are in the habit of taking out dredging nets, and collecting specimens for us, having been furnished with a table of directions for the purpose by our curator, Mr. Stutchbury. Our accumulations from this source are, we are happy to state, daily increasing.

7. Of Crustacea our series is also good.

8. In Ichthyology we possess only a few skeletons of fishes, about fifty preparations in spirits, and a few stuffed specimens.

9. In Erpetology we possess both skeletons and stuffed specimens of crocodiles,* and other saurians. Our series of chameleons is nearly complete, wanting only two species; and of the testudinata we possess twenty or thirty species. In the whole of this department our collections are very unusually rich for a provincial museum.

10. In Ornithology we possess about one thousand stuffed species, and nearly forty skeletons, including eagle, ostrich, cassowary, wild swan, &c. We are very rich in foreign species, especially in the brilliant varieties of the tropics.

11. In Mammalogy our collections exceed one hundred stuffed specimens, including very many of the foreign carnivora. We have also near fifty skeletons, including lion, tiger, and several others. Of the elephant we possess three skulls, in one of which the tusks are replaced by exact models, formed from the originals.

We believe that the present article will be the means of making much more extensively known than previously, even among the inhabitants of our own city, the nature and extent of the stores of natural history placed at their disposal by our institution; and it will probably be the first means of making more widely known, beyond our own immediate neighbourhood, particulars so highly creditable to the zeal and spirit of our citizens, who have in so short a period, (not exceeding ten years,) laid so deeply and widely the foundations of a museum, which will very shortly leave the zoological student but little to desire. Most proud and happy shall we be, if our humble labours may in any way tend to advance its interests, or extend its efficacy. Nothing will gratify us more than to see our friends examining its stores, with our little manuals in their hands; thus illustrating our brief sketches by a full examination of the natural objects to which they refer, and bringing to that survey the knowledge of the general principles of the science, which it has been our aim to communicate.

* We have also a specimen of the crocodilus suchus; being an Egyptian mummy of the animal, presented by Lord Mountnorris.

SYNOPTICAL TABLES.

	DIGESTION.	ABSORPTION *of Chyle.*	AERATION.
ZOOPHYTES. Polypi, actiniæ, medusæ.	Food received without mastication into intestinal cavity simply hollowed out in the animal mass, and digested by a mucous fluid exhaling from its coats Liver none, or doubtful. Single aperture serves for both mouth and vent.	By simple imbibition into the pores of the animal mass.	The nutritive fluid, in thus generally percolating the system, appears to require only more contact with the aerated water surrounding the external surface, in the actiniæ; but in the medusæ, a system of ramifying vessels, having external openings, conveys the water through the body: these may be called aquiferous trachcæ.
RADIATED ECHINODERMATA Star fish, encrinites, echini, holothuria.	A manifest liver is observable in all this division; and the echini have an apparatus for mastication attached to the mouth, which is distinct from the vent and long convolutions of the intestine; but in these respects the star fish are nearer to the lower class.	Simple imbibition.	By means of a system of aquiferous trachcæ, which bring the aerated water in contact with the nutritive fluid.
ACEPHALOUS MOLLUSCA. A. Without shells; biphori and ascidiæ. B. All the animals inhabiting bivalve shells.	No distinct mastication; stomach, liver, and intestine. Vent always posterior.	The ordinary vessels act also as absorbents of the chyle.	By means of vascular branchiæ. In the naked acephala lining the inside of a sac between the outer mouth and the pharynx. In the conchifera disposed in laminated fringes skirting the sides and lower margin.
CEPHALOUS MOLLUSCA, *with distinct heads.* Mostly inhabiting univalve shells: also cuttle fish.	Distinct teeth for mastication in many genera; in others a prickly tongue. Stomach, and occasionally gizzard. Liver and long convoluted intestine; vent variously placed; but in the univalves, on the same side with the spire of the shell.	As in the last division.	Most breathing water by branchiæ of various forms; but the pulmobranchia breathe air by a pulmonary cavity.

INARTICULATA.

CIRCULATION *through the System.*	MUSCLES *and solid frame-work on which they rest.*	NERVOUS SYSTEM *and Senses.*	REPRODUCTION.
Simple general percolation of the nutritive fluid through the pores of the animal mass.	The general animal mass possesses contractility, but rarely distinct muscular fibres. This general contractility gives rise to the requisite motions of the parts, and to locomotion in some genera; but many are permanently attached to a single spot.	No distinct nervous system, but apparently a diffused sense of touch, or rather irritability from contact	Fissiparous as well as oviparous; the latter obscure and approaching to gemmiparous, the system is consequently monœcious.
Traces of a vascular system with a cordal sinus exist in this class, but they are obscure and confounded with the aquiferous tracheæ.	Distinct muscular fibres, which, in the echini move the spines. A vast number of filaments protruded through the perforations of the shell in the echini and asteriæ and attaching themselves to neighbouring bodies, co-operate in locomotion, much as a vessel in harbour is warped along by cordage.	Same as above.	Fissiparous as well as oviparous; monœcious; the ovarial system perfectly distinct, and traces of a fecundating system.
Regular vascular system, with an aortal heart.	Distinct muscles; attached to the shell in the conchifera; locomotion various. Some conchifera are permanently fixed; those which change their place, have a projecting muscular foot.	Nervous filaments and ganglions. Sense of touch is very exquisite, especially along the margin of the mantle in the conchifera; but there is probably no other specific sense.	No longer fissiparous, but oviparous and monœcious, as in the last division.
Generally as in the last division; but the cephalopoda, (cuttle fish) have two distinct branchial hearts and one aortal.	As in last division; but the muscular system is far more advanced in the cephalopoda.	Cerebral ganglion near origin of œsophagus, with optic, and sometimes auditory processes; distinct ganglions for sensation and motion. System most developed in cephalopoda, which alone possess organs for hearing; but sight and touch are common to the whole division.	Systems very various, being either monœcious, with or without reciprocal fecundation. Some genera are oviparous, others ovoviparous.

ARTICULATA.	DIGESTION.	ABSORPTION *of Chyle.*	AERATION *of the Blood.*
CIRRHOPODA, OR MOLLUSCA ARTICULATA. A link between the two orders, including barnacles.	Simple intestinal canal, terminating at the base of a long tube. A liver is present.	By ordinary veins.	Branchiæ attached to the base of the legs.
ANNELIDA. Serpulæ, marine worms inhabiting tubes of sand, &c.; and earth worms.	Intestinal canal, sometimes a simple tube; sometimes dilated into many pouches. No liver.	Same as last division.	Branchiæ, sometimes placed at one extremity of the body, sometimes distributed through its length, interiorly or exteriorly; in some genera so obscure as to escape observation.
INSECTA.* In the larva state vermiform, like annelida in the perfect imago state, furnished with wings, except the aptera, (centipedes) including hemiptera, (aphides) orthoptera, (grasshoppers) coleoptera, (beetles) neuroptera, (dragon flies) hymenoptera, (bees) lepidoptera, (butterflies) diptera, (common flies.)	Œsophagus often dilated into a crop, and having at its lower part a gizzard for triturating the food. The stomach very large in the larva state, reduced in the imago. Hepatic vessels opening into the lower portion; perform the functions of liver. Small intestines most developed in the imago state, when the stomach is reduced.	The chyle appears simply to transude from the intestines into the general pores of the surrounding parts, where the fluids undergo a diffused circulation.	Numerous tracheæ opening in external orifices and ramifying internally, pervade the body, and thus convey air throughout the diffused circulation.
ARACHNIDA. Spiders, scorpions.	As in insecta.	As in insecta.	A double series of pulmonary cavities, covered with ramifying blood vessels, four on each side of the dorsal vesssel.
CRUSTACEA.	Stomach sometimes as in lobster, furnished with an apparatus for trituration, consisting of calcareous lines in a cartilaginous frame-work; an ample liver.	By ordinary veins.	Branchiæ attached to the base of the legs.

* In insecta there are generally thirteen segments; 1. the head; 2. carrying the fore legs; 3. and 4 carrying wings and legs. These three constitute the thorax, the remaining nine the abdomen.

LATA.

CIRCULATION *through the System.*	MUSCLES *and solid frame-work on which they rest, and organs of loco-Motion.*	NERVOUS SYSTEM *and Senses.*	REPRODUCTION.
Regular system of vessels, with an aortal heart.	Regular system of muscles: twelve many jointed legs.	Series of ganglia, connected by a double nervous cord, sense only of touch, having no distinct head or organs of sight, &c.	Monæcio-diœcious, or of reciprocal fecundation, oviparous.
A dorsal and abdominal vessel, with two lateral vessels and numerous ramifications: no distinct heart. In the earth-worm the system is more advanced, the dorsal and abdominal vessels being connected by muscular sinuses, forming as it were groups of hearts.	Regular muscular fibres. Some genera have mamillæ, furnished with bristles, which act as legs.	Nervous cord and ganglia; sense of touch. Some genera have distinct heads, bearing antennæ and imperfect eyes.	Same as last division.
A long dorsal vessel, contractile and pulsatile, supplies the office of a sort of heart in giving impulse to the circulation, which is generally diffused through the system, but assisted by lateral vessels, sending out loops to particular organs.	Regular and complicated system of muscular fibres to which the scaly integuments, constituting an external skeleton, afford a solid frame work; generally six jointed legs, and two or four wings in the imago. The caterpillars have bristly tufts on their segments like the annelida.	Series of ganglia, connected by a double nervous cord; in the larva state much as in the annelida. In the imago state the ganglia approximate and coalesce into larger and less numerous masses; distinct optic nerves, probably also of taste, smell, and hearing; supposed distinct branches of nerves of motion and sensation.	Diœcious oviparous.
The dorsal vessel is still more analogous to a heart, and connected with a regular vascular system.	Regular muscular system, legs generally exceeding three pair; the front pair often large claws.	As in insecta.	Same as last division.
Branches of venæ cavæ sent out to branchiæ, dilate into muscular sinuses, forming branchial hearts, and the branchial veins convey the blood back into an oval vessel, forming an aortal heart.	Regular muscular system, having one pair of large claws and four pair of legs.	As in insecta, but the nerves and organ of hearing more distinctly developed.	Same as last division.

VERTEBRATA.	DIGESTION.	ABSORPTION *of Chyle.*	III. VERTE- AERATION *of the Blood.*
FISHES.	Mastication and trituration of the food sometimes by the teeth and the bones of the palate; sometimes by a muscular stomach. The alimentary canal short; stomach continuous with, and little distinguished from intestines; liver generally extensive. The gall bladder and pancreas are only found in some species.	By lateral vessels, which are here only simple tubes, and destitute of valves to prevent the retrograde motion of the chyle.	Branchiæ feather-like, disposed on each side the throat in double rows, attached to osseous arches connected with the os hyoides.
REPTILES.	Teeth for mastication; simple and capacious stomach; liver, pancreas, and gall bladder; short intestinal canal.	Lacteals larger and more distinct, but valves still imperfect.	Regular lungs.
BIRDS.	In carnivorous birds the stomach is a mere membranous sac. In granivorous birds a muscular gizzard is added for trituration; an ample liver, pancreas, &c.; intestinal canal more developed.	Lacteals, with valves numerous and efficient.	Regular lungs, but the branchial divisions of the trachea do not terminate in them, but communicate with a series of large air cells enveloping the viscera, so that in each respiration the air passes through the lungs twice; once in its passage to the air cells, and again on its return.
MAMMALIA.	Teeth for mastication. Stomach in carnivora only simple membranous bag, in the herbivora, divided into two compartments, and sometimes more; in the ruminantia there are four; from 1. the paunch, the food passes to 2. the honey-combed stomach, whence it is thrown again into the mouth, and after being a second time chewed, descends into 3 and 4. Liver, pancreas, &c. and voluminous intestines.	As in last division.	Regular lungs.

BRATA.	MUSCLES, *frame-work on which they act, and organs of Motion.*	NERVOUS SYSTEM *and Senses.*	REPRODUCTION.
CIRCULATION *through the System.* A single but divided branchial heart receives the venous blood from the system and propels it to the branchiæ; but there is no systemic heart, the general trunk of the branchial veins being continuous with the aorta, without any intervening dilatation	A regular system of muscles and vertebrated skeleton. The vertebral column is very flexible, and is the great instrument of progression. A pair of pectoral and another of ventral fins, correspond with the anterior and posterior extremities of quadrupeds. These are wanting, and the vertebral column only in a rudimentary state in some apodal and cartilaginous fishes, which form the link between the vertebrata and invertebrata.	Brain with medulla oblongata, cerebellum optic tubercles and cerebral hemispheres, but the latter little developed; all the five senses; spinal cord conveyed on the back of the vertebral column, sending forth from its posterior filaments, nerves of sensation, and from its anterior, nerves of motion.	Diœcious and oviparous, or in some species ovoviviparous.
A single aortal heart, but branches of the aorta convey a portion of the blood to the heart, so that its aeration is only partial.	Regular muscles and vertebral skeleton, with four extremities for locomotion, except in the serpent tribe, which crawl on the extremities of their ribs.	As in last division, but cerebral hemispheres more developed.	As in last division.
Double heart, the right ventricle propelling the blood through the lungs and the left ventricle, sending it by the aorta into the general system.	Regular muscles and vertebral skeleton, with four extremities, the exterior pair converted into wings. To give motion to these the muscles of the chest and the osseous frame-work are greatly developed; & for levity the bones are hollow and inflated with air through air cells communicating with the trachea.	As above, but cerebral hemispheres still more developed.	Diœcious and oviparous.
As in last division.	Regular muscles and vertebral skeleton; four extremities, (except in the whale tribe, which want the posterior pair), these are varied to accomodate them to the purposes of walking, climbing, and prehension, as the wants of the animal may require.	As above. Maximum development of cerebral hemisphere.	Diœcious and viviparous. Female parent gives suck to her young.

ON THE RELATIONS BETWEEN MIND AND MUSCLE;

(Being the substance of a Paper read before the Philosophical and Literary Society of Bristol, Dec. 1834.*)*

BY J. A. SYMONDS, M. D.

PART I.

Muscles and their contractions have commonly been divided into voluntary and involuntary; a distinction which involves many anomalies, and may lead, and indeed has led to considerable confusion. The muscles which are employed in the mere organic functions, have been placed in the latter class, while those which subserve locomotion have been grouped in the former. But it is well known that certain motions which are for the most part independent of the will, have in some instances been subjected to its controul, and on the other hand, that in a great number of those which are designated voluntary, volition has very little concern, and that every one of them might, under certain conditions of the system, be brought into play in direct opposition to that principle; so that the most that can be said for this classification is, that it is based on the general fact, that the one groupe act nearly always without any stimulus from the will, while the others own this faculty, if faculty it be, as a very frequent instigator to action.

An arrangement less subject to exception, and adopted by many physiologists, is that which distributes muscular motions into those which maintain the nutritive or vegetative life of the system, and those which enable it to entertain relations with surrounding objects. On the latter, principally, is it my intention to offer the following remarks, in which I shall restrict myself to the consideration of the connection between the movements in question, and certain mental phænomena.

The first inquiry that presents itself is, what is voluntary motion? If we apply to etymology, we shall only make out that it is motion related with desire, wish, inclination, preference, &c. But as the word *voluntary* has acquired a signification of more import than its root, we must not content ourselves with its derivation. When a person has desired an object, and gained possession of it by means of certain muscular contractions, he is said to have executed a voluntary movement. But what was the process? Let us suppose that the object was a book upon the table before him. After questioning his consciousness, he can enumerate no other events than the wish to take up the book, the belief that the action will ensue, and the movements of his hand and arm, which accomplished his wish and confirmed his expectation. This, however, may be considered so customary and mechanical an action, as scarcely to present a fair example for educing the operation of volition. Let us choose then a movement entirely new to the individual. He wishes to pass a sword between two powerful magnets,

which are in rather close proximity to each other; he executes this difficult manœuvre; and we ask, what have been the events in the process? He wished to hold the instrument fast, and his hand grasped the hilt; he wished to move it forward, and his arm was projected; he wished to move it in a line midway between the magnets, knowing that in that direction their mutual antagonism would assist him in overcoming the attraction of either one; he felt on a deviation from this line a strong attraction, and he wished to move the weapon in an opposite direction, but not so far as to encounter a similar difficulty on the opposite side. His wishes were accomplished; and he can give no additional information, if he merely scrutinizes his own consciousness.

But this instance again may be objected to, on the ground that although the general resultant action is new, yet the elementary movements are so familiar, as not to have required the occurrence of volition. To select then an example entirely free from any exception of this kind; let us suppose that the individual wishes to bend his arm; the flexion is effected; and again we enquire, what were the events in the process? It cannot now be said that the action was not attended to, in consequence of the mind being occupied with the ulterior object. The motion of the limb was desired, and the motion took place; this is all that can be learned from the agent. But it is the opinion of many philosophers that there was an intermediate event, to wit, volition. They hold that *to will* and *to wish*, imply separate states of mind; and they describe volition as a mental attempt anterior to muscular motion, and subsequent to, and determined by, desire. In other words, the agent first wishes, then wills, and then acts. By what arguments is this view supported?

In the judgment of some persons, it may perhaps derive no little force from the notion, that the will is something active and spontaneous, while desire is altogether passive, and must consequently be a separate mental condition. Now the idea of activity is said to have two sources; the one consisting in our observation of certain bodies which move without apparently being operated upon by other bodies; the other consisting in the fact that we are unconscious of any external event that stands in the relation of cause to our own movements, or in other words, in our belief that these movements are self-impelled. In each of these cases, the notion of activity results from the non-appearance of any prior event; in each we take a limited series of events, the first of which is viewed with reference to those only that follow, and not to any preceding series. But surely the same notion of activity arises in our minds, whenever we view any limited set of phænomena whatever; (for with our imperfect faculties we are unable to survey the whole series up to the great First Cause.) Each detached series has, by virtue of its detached circumstances, an initial event, which is active with relation to all the events that follow it. Thus we say that an acid *acts on* a metal; the acid is viewed only in its relation

of antecedence, and has an active character; but how came the acid in contact with the metal? It is now considered with reference to a series of phænomena that have gone before, and immediately assumes a passive aspect. The same holds good with every event that that we know of; it is active as an antecedent, passive as a consequent. It is easy then to understand why desire is generally considered as a passive emotion; it is because this feeling is contemplated in a series of events of which it is the conclusion; the series being, the presentation of the object, the perception of the object, and the desire of the object. Volition, on the contrary, obtains its active character from being viewed in relation to certain movements which succeed it. But is it not possible to make these two conditions (supposing them not to be identical,) exchange characters? Unquestionably; and simply by considering them in relation to each other; for desire has then the priority of occurrence, and consequently is active, while volition is necessarily passive.

There does not appear then sufficient reason for denying the identity of volition and desire, on the ground that the one has an active and the other a passive quality. Let us endeavour to try the value of another argument.

There must certainly be an operation intermediate to desire and action, it is urged, or to what can be attributed the *feeling of effort?* for surely this is something different both from the wish, and from the action which is the object of the wish. This is a proposition which requires a very close scrutiny; for if there really be a feeling of effort, *sui generis,* incapable of resolution into desire or action, the question is at an end; the feeling is the tertium quid, the very volition whose existence we are discussing. In order that we may better understand in what an effort consists, it will be convenient to take one or two illustrations. A man wishes to snap a piece of cord by which his hands are tied; we see him separate them suddenly, and the band is broken. In describing the action, and the mental condition which preceded it, we should merely say that the man wished to break the cord, and that he broke it. But if the first motion of the hands is not followed by the rupture, we then say that he made an effort to that effect; but in what respect do the two cases differ? The wish was the same, and the muscular motion the same; in the one case these events were followed by the desired event, in the other they were not. To this it may perhaps be answered, that there is in reality an effort, no less in the former than in the latter instance, since it occurs before the muscular action, and consequently is not dependent on the fulfilment or on the non-fulfilment of the ulterior object, and that it is only in common parlance that the use of the word effort is confined to the unsuccessful series of events, it being lost sight of in the other instance, or confounded with the action itself. To avoid then any confusion of this kind, let us view the individual in the act of straining the cord. Had we never seen a person so employed before, and were we ignorant of the effects of tension on such a substance, we

should merely say that he was forcibly pulling the cord in opposite directions; but if we once get into our minds an idea of his ulterior wish, we declare that he is making an effort. Here again the word is used with reference to something which is to be subsequent to the muscular action, not to any thing that has preceded it.

Let us take another example, and the strongest that can be found in favour of the doctrine of effort and volition. Such an one, I think, will be met with in the case of a person, who having a recently-paralysed limb, is desirous of moving it in the customary manner. It remains motionless; but the individual is said to make an effort, though a useless one, to exert his volition, though in vain. "Is it to be imagined," says a spectator, "that the mental state of the individual is nothing more than an emotion of desire, when I witness his earnest look, his compressed lips, his close-set teeth, his distended nostril, his flushed cheek, and his starting eye?" "Did I experience no other mental affection than a wish?" asks the sufferer himself, when he sinks back on his pillow, exhausted by his futile exertions. To the former it may be replied, that the phænomena which he has enumerated, and considered indicative of a peculiar state of mind, distinct from desire, are the results of instinctive actions which accompany the intense desire of any particular movement; that they nearly all belong to a set of respiratory muscles, which are employed in preventing the egress of air from the chest, a condition essential to all difficult motions; and that the actions in question may be singly or collectively designated an effort; but he must bear in mind that in themselves they involve no affection of consciousness. The question of the paralytic himself may be met by the request that he will describe his own feelings; for in doing this he can enumerate nothing that is not resolvable into the desire of the movement, and the consciousness of the occurrence of certain respiratory actions, which he has often experienced prior to, or concomitant with, the desired action, and which he therefore denominates efforts. Or tell him to use these respiratory muscles in a similar manner, but without reference to any ulterior action, and then enquire what he has felt. He will be unable to do more than enumerate the wish that arose, at the suggestion, for those muscular actions, and their consequent occurrence; for he is precisely in the same predicament, as the individual of a former instance, who desires or wills the flexion of his arm.

In all these instances, analyse them as carefully as we will, we fail to discover the slightest evidence of any separate mental condition, corresponding to what is designated an effort. However real and palpable the notion may at first sight appear, when pursued it is found to be a phantom, and there is nothing to grasp but the desire and the movement *between which* the fugitive shape had hovered.

An examination of the word *effort*, or of its synonymes, *attempt, endeavour*, &c. in their metaphorical applications will lead to a similar result. An

effort whether in the organic or in the inorganic world, will always be found to express the relation of an event to a series of which it *is*, or *has been* formerly experienced to be, initial or antecedent. The chemist having discovered at the bottom of his crucible an amorphous matter, which he remembers in former experiments to have been the commencement of a number of changes which terminated in the formation of crystals, declares that there has been an *attempt* at crystallization. The anatomist, when a mal-formed organ is submitted to him, knowing that the animal, to which the organ belongs, traverses in its embryonic development a series of organic forms permanent in the lower tribes, scarcely hesitates to say, that nature has made her usual *efforts* to form a more complex organization, but that they have failed; or the zoologist, if he be as loose a reasoner as Lamarck, may pronounce all the inferior species to be so many *attempts* at the production of more perfect ones, like the imperfect crystallizations of the chemist. The pathologist having observed certain phænomena in the course of a fatal disease, may assert that they were the *endeavours* of nature to effect a cure, because on former occasions he has noticed such events to have been followed by a series of others, which ended in recovery. But not to multiply examples, we may conclude by remarking, that in all of them the word effort is applied to an event or to events which bear the same relation to other events, as the desire of certain actions, to the occurrence of those actions.

Our inquiry into the nature of activity and effort, having failed to produce any evidence of the separateness of desire and volition, let us examine another kind of proof.

Mr. Locke observes, that "Desire may have a contrary tendency to that which our will sets us upon." Dr. Reid takes the same position; and recently it has been maintained with great earnestness by Dr. Chalmers, in his Bridgewater Treatise. From the illustrations adduced by these authors, it appears to be their opinion, that those muscular movements which take place to achieve objects that are disagreeable to us, cannot be the products of desire. But in order that we may desire a thing, is it necessary that this should be of an agreeable nature? When two events or actions, each productive of pain, are presented to our consideration, does not that which is less painful immediately become an object of our desire? Do we not daily observe that persons eagerly long for the infliction of certain surgical operations, in order that they may avoid the continuance of severer suffering? The nauseous draught of medicine, which, according to Dr. Chalmers, is taken by virtue of an act of volition in opposition to desire, appears to us to be itself an object of desire, because viewed as the mean of preventing or removing indisposition. The cases brought forward by Dr. Reid, as exemplifications of an opposition between will and desire, have been fully analysed by Dr. Brown, in his Treatise on Cause and Effect, and proved to shew nothing but the opposition of one

desire to another, and the determination of the action by the predominating desire. The work just mentioned, renders it needless for us to dwell longer upon the argument in question, and we shall therefore content ourselves with a remark upon the common phrase, "to act against the will." Will is here employed in the sense of desire; this must be allowed by even the most sturdy asserters of the separateness of will and desire. But as the *act* implies a volition, or effort of the *will proper*, they must say that an individual may will an act against his will. To our apprehension it would be equally correct to say, that he desires an act against his desire; in other words, that one desire is opposed to, and predominant over the other. When, therefore, we talk of acting against the will, we omit the mention of the desire which determined the volition, and only intimate the opposition of the action itself to the first of the two desires. The following example will perhaps exhibit this point in its true light. A school-boy is aroused from his slumbers, and his happy dreams of hounds and horses, by the dissonant clang of the matin bell. The first desire that arises in his mind is to renew his repose, and the pursuit of his pleasing illusions; a second emotion arises in the form of a desire to avoid some discipline, or to obtain a prize for diligence and punctuality. If the first be the stronger, he sinks back upon his pillow; if the latter, he leaves his bed, and he says, "against his will," in which phrase he specifies the vanquished desire, and leaves the other to be inferred from the action which it has determined. The continuance or return of the resisted motion does not argue against this view; it is still a weaker emotion, notwithstanding the subject of it may say that he would have much preferred remaining in bed; for by this he only means, that continuing in bed would have been more agreeable than his present condition, while he neglects to mention the ulterior object, the contemplation of which was the cause of his being where he is.

Another objection to the identity of desire and volition, is founded upon the assertion that the latter is conversant with our own acts only, while the objects of the former are external to us. But this we consider to be weaker ground than even either of the former positions. It is true that as the words are used, we may desire the actions of a foreign body, but can only *will* our own; and if we set out with the assumption that volition and desire are different faculties, this would appear a very natural character of distinction. But the nature of the object does not alter the mental condition. Whether a red rose or a white rose be presented to the eye, the mental state is still a vision; and in like manner, whether a person wishes a cloud to pass before the sun, or the motion of one of his limbs, the mental state is in either case, *desire*. But if this be true, how is it, some one may ask, that we give this particular instance of desire a specific designation, viz. will or volition, while all the other species possess only their generic name? We apprehend the reason to be simply this; that in the former instance, *the desire bears the relation of cause to the subsequent*

action, while in the latter there is no such relation. The muscular movement takes place, *because it was desired;* our experience of the invariable sequence of these two events, induces us to describe them as cause and effect; but the passage of the cloud over the sun, if it chanced to follow our desire, we know full well was not the effect of the latter, because our experience has often recognized the occurrence of these events without a similar chain of sequence.

Let us glance at one more objection contained in such a question as the following,—"How are we to explain the case of a person who desires to move his limb, but being convinced of the impossibility of the action, does not choose to exert his volition?" In this query there is in the first place an assumption that a person *can* desire what he believes to be impossible; and secondly, it is overlooked that the desire of the movement must necessarily induce, as we have shewn above, those initial or preparatory actions which constitute an *attempt,* or volitional exertion. Can we entertain a desire, though believing in the impossibility of gratifying it? Certainly not. To desire an object, and to feel that it would be very agreeable, if possessed, are two very different states of mind. "I should like so and so," has a very different signification from "I wish or desire so and so." The former expression might be used by a sensible person with reference to any thing physically impossible, such as a visit to the Dog-star; but the latter applied to the same object would indicate undsoundness of mind. The difficulty in relinquishing what is called a useless desire, depends on the difficulty of believing that it is useless. A mind unhinged by the wrench of a dreadful bereavement may long for the return of the dead, but it is because that mind is incapable of considering the circumstances which render the object of its desire impossible. A child both wishes and asks for many impracticable delights, and the most effectual method of stopping such desires is to convince him that they cannot be realized. A culprit may be anxious for the release of his limbs from the stocks, but has no desire to remove them himself, because he believes the action to be impossible; he consequently makes no *efforts* at extrication so long as he entertains this belief, which efforts, however, would occur by necessity, if he experienced any desire. To return to the case more immediately before us; if the paralytic can be convinced that it is possible for him to move his limbs, the corresponding desire immediately arises, and is followed either by the movement in question, or by those respiratory actions which constitute an effort.

Thus far then in our inquiry we have been unable to discover any event intermediate to the desire, and the occurrence of the muscular movement which is its object. It has been seen, however, that the former stands in the relation of cause to the latter; which cannot be predicated of it in connection with any other object. Volition then, or will, if we understand it rightly, is an expression of this relation; in other words, *to will,* in its

strict sense, is to wish a muscular action. It is in its character of *cause*, that the word *will* is almost always applied to the desires of the Deity; because it is obviously impossible to conceive of any condition of the Divine mind, which is not necessarily followed by the event which is its object. In like manner, the inclination of a monarch in the affairs of his kingdom, is often designated as his will, because the desired effect nearly always follows. So again the wish of an individual with regard to the disposal of his property, being rendered more or less certain of execution by the law of the land, is termed his will. When we say that our desires have been gratified without the intervention of our will, we only express circuitously that the occurrence of the desired event was not the *effect* of the desire.

Before quitting this part of the subject, it may be remarked, that volition is often supposed to be exercised in choice or preference; but we trust there is no need to point out that this is an improper application of a term which belongs only to muscular action and its cause in the mind; choice, as we shall see presently, being nothing more than the strongest of two or more desires, and having no necessary connection with action. *Intention, resolution, determination,* &c. are only forms of the same mental condition, the choice of some action or line of conduct, that may appear more desirable than some other presented to our contemplation. Is there no difference then between the phrases, "I wish to study Geology," and "I intend, or have resolved, or have determined, to study Geology?" Unquestionably. In the former instance I express a wish, but by no means intimate that it exceeds my inclination to stay at home, and attend to pursuits that demand less corporeal exertion. In the latter, I declare that my inclination to the study predominates over any opposing desire.*

In considering the nature of resolution, we must be careful not to confound it with volition, which so often occurs, though not necessarily, between the resolution and its achievement. Our resolves are executed more or less by muscular actions of some kind or other, whether by speaking, writing, locomotion, &c. Volition we have said is the desire, whose object and result is muscular movement; but as the latter may have other causes, volition is not necessarily implied in the execution of a desire. Thus I may resolve and announce that I will fetch something from an adjoining

* The auxiliary "I will" intimates both wish and resolution, and in addition, perhaps, a decided expectation of the future event—"*I shall*," expresses little more than a prediction; at all events it is improperly used if made to express inclination, since *shall* is derived from a Saxon word, signifying "ought," and therefore implies the operation of some agent prior to the agent spoken of, or in other words is *passive*. This will appear more evident, if we choose another pronoun. If I say that "*he* will study Geology," I predict his occupation, and only trace its causation as far back as his own mind. "He shall study," &c. at once declares that the beginning of that series of events which ends in his geological occupation, is something external or prior to his own feelings on the matter.

room, and may execute my intention and prophecy, without the occurrence of a single volition; for my muscles may have acted without my consciousness, and consequently without my desire. But this point will be discussed more at large, when we speak of the different motions and their causes.

The origination of desire is a complicated subject,* but it will serve our present purpose sufficiently to state, that this emotion may arise in two ways; first, it may be the immediate consequent of a simple bodily feeling, of an external sensation, or of a conception; secondly, it may be the result of a comparison of two objects, or a judgment. In the former case it is instinctive; in the latter, it has been termed choice or preference. Instinct is manifested, not only in the properties which urge the lower animals to some of their most important functions, but also in human appetites, and in those vehement wishes which suddenly start up, particularly in the minds of children, on the perception or remembrance of any pleasing object. No period of existence after birth is too early for the development of this form of desire. Witness the chicken catching at a fly while in the act of breaking from its shell, and the young infant stretching forth its hand towards some glittering object. What may be the nature of those desires which induce the lower animals to place substances in a particular mechanical arrangement, as in the construction of a nest, a honey-comb, the winter-quarters of the beaver, or the web of the spider, it is vain to conjecture.

Choice is more capable of analysis than instinct. The remembrance of former experiences, the resemblances of events, the expectation of like effects from like causes, the balancing of probabilities, all participate in the production of that state of mind in which one of two objects appears more pleasing or less painful. But this kind of desire is by no means confined to the human species. A cat may feel an instinctive longing for a bird in a cage, but remembering that the execution of her desires on a former occasion was accompanied with an injury to her claws, which produced pain in a greater degree, than the feast on the victim produced pleasure, remains quiescent.

The accomplishment of desires, which ever be their class, is effected by muscular motions; and these are hastily called voluntary, for no other reason than that they are concurrent with or not opposed to desire, without its being duly considered whether they result from intermediate desires, of which they are the sole objects. Out of the infinite number of muscular

* It is almost superfluous to observe, that the view which has been taken of volition, as a relation of cause and effect between desire and muscular motion, is in perfect accordance with the free agency of man; since if we act in consequence of desire, we act as freely as possible, that is, precisely as we like. How we like, and how we desire in all cases, are questions of difficult solution; but one thing is certain, that motives of the greatest cogency have been provided by our Creator and Moral Governor, both in the dictates of conscience and in the precepts of revelation.

contractions which we daily and hourly exercise, how few are voluntary in the strict sense!* Nor is it very easy to separate the latter from those which derive their character of voluntariness from the mere circumstance that they are not inconsistent with, or might be suspended by our will or desire. Perhaps the readiest mode of ascertaining them may be to select those which certainly do take place, without any *efficient* desire, and thus to arrive at the others by what our neighbours call "la voie d'exclusion."

It may seem at first sight, with reference both to what has been already advanced, and to what remains to be said, that the *nervous* connections of muscles have been overlooked; but a little reflection will shew that our remarks upon the action of muscles, apply equally to the nerves which excite those organs. A change in the nerve supplying a muscle, must undoubtedly take place before the latter can act in obedience to the stimulus of desire, or of any other of the causes to be mentioned hereafter. When we speak of muscular contraction as following immediately upon desire, we by no means wish to intimate that the muscle contracts without a prior affection of its nerves, and indeed of that part of the central nervous organ with which they are connected;—we mean only that desire is the last state of consciousness, or that which is immediately prior to that series of organic phænomena, which constitute nervo-muscular action.

The motions independent of desire, may be arranged under the following heads:—

1. Motions immediately consequent upon certain organic conditions, without sensation.
2. Upon simple internal sensations.
3. Upon external sensations.
4. Upon emotions.
5. Upon a vague principle called imitation.
6. Upon habit.

(To be concluded.)

* It might perhaps obviate confusion, to characterize such motions as *volitional.*

REVIEW.

Mathematical Researches, Parts I. II. III. By G. B. Jerrard, A. B. 1832, 4, 5. Strong, Bristol.

Such is the unattractive title by which the author sends forth his speculations on a refined and difficult subject; a subject on which it is notorious that the ablest mathematicians have so lost their labour, that many may be deterred from reading, by a persuasion that the task is hopeless. It is not quite accordant with the plan of this Journal to enter on the abstruse parts of analysis; nor can we afford much space at present. Nor are we apprehensive that Mr. Jerrard needs our praise; as the talent displayed in these unpretending tracts is such as will sooner or later be acknowledged.

The utmost that we can attempt is, to communicate information concerning their contents.

Those who have but touched the second part of Algebra are aware, that equations above the fourth degree are not solvible in general terms. One, however, who reflects how little use is made of the finite solution of equations of the third and fourth degrees, will see that there is no great result to be anticipated as a direct consequence of solving the higher equations. It certainly is not *in itself* the field in which one would desire to see superior talent spending itself. But when a problem has long baffled mathematical ingenuity, then, whether it be solved, or be proved insolvible, either event will ordinarily give us a fuller acquaintance with the whole subject; and the methods by which the question has been settled will often prove fertile in other results. This we feel to be the case with Mr. Jerrard's Researches. He has so extended the Calculus of Symmetric Functions, correcting the bad notation of his predecessors, and inventing a most comprehensive and methodical notation of his own; that he will as justly be named the author of this new Calculus, as La Grange of the Calculus of Variations. Such an invention is a powerful engine, the effects of which we cannot at first ascertain.

The use of $\int 1\ \int 2\ \int 3 \ldots$ for the sums of the first, second, third .... powers of the roots of a *given* equation, is familiar to the ordinary books. Newton gave the formula for finding $\int n$, and it is hence easily shown that every rational symmetric function of the roots is a rational function of the coefficients, even thongh the roots be impossible. The notation $\int n\,m$, $\int n\,m\,r \ldots$ has also been used to express the union of roots two and two, three and three, ... in symmetric functions wherein each term is formed, as $x'^m\,x''^n$, $x'^m\,x''^n\,x'''^r$ .... respectively. But it seems strange, (now that Mr. J. has pointed it out,) that $\int m\,m$ was defined to mean *something else* than the result obtained in $\int m\,n$ by putting $n=m$: viz. the latter was made to be *double* the former. So; $\int m\,n\,r$, taken when $m=n=r$; was made to be (2×3) times $\int m\,m\,m$. This breach of analogy was an insuperable barrier against the progress of the calculus. Having set this right, Mr. J. is able to generalize and to discover beautiful modes of condensing expressions. By separating the symbol $\int$, upon the principles advocated by Herschel, he solves with equal simplicity and elegance the general problem of elimination. Given $X=0$, $X'=0$, two integer functions of x, to express the relation between the coefficients, independently of x, by an equation of the lowest possible degree.

$$\left.\begin{aligned} \text{Put } X &= p + q\,x + r\,x^2 + \ldots + l x^m \\ X' &= P + Q\,x + R\,x^2 + \ldots + L\,x^n \end{aligned}\right\}$$

M. J.'s result by the elimination of x is then

$$P^m + \frac{a_1}{1} P^{m-1} + \frac{a_2}{1.2} P^{m-2} + \ldots + \frac{a^m}{1.2\ldots m} = 0$$

wherein $a_\mu = \int (1\,Q + 2\,R + \ldots + n\,L)^\mu$

It will be understood that in the last expression, after developing the part beneath f, this symbol is to be applied to each term separately, alway remembering that $Q, R, \ldots . L, \mu$, are not to be affected with it. Also f has reference to the roots of $X=0$.

Partially modifying the problem, if $X = 0$, and $y = \phi x$, (an integer function) we obtain an equation in y;

$$y^m - \frac{A_1}{1} y^{m-1} + \frac{A_2}{1.2} y^{m-2} - \&c. \ldots . \pm \frac{A_m}{1.2 \ldots m} = 0$$

wherein, if $\varphi x = P x^\alpha + Q x^\beta + \ldots . + L x^\lambda$

$$A_\mu = f(\alpha P + \beta Q + \ldots + \lambda L)^\mu$$

This result may be obtained immediately from the known relation between the roots and coefficients of an equation, by help of Mr. J.'s section. He proceeds farther, to assign $\alpha \beta \ldots \lambda, P Q \ldots L$ such that the equation in y may fulfil particular conditions. This problem *could not even be contemplated* before it had been shown how to express the equation in y. He first inquires how to reduce a given equation of the m^{th} degree, $X = 0$, to a form in which its second, third, and fourth terms shall have all disappeared. This he solves most satisfactorily; and when it is known what mathematicians have failed in the attempt, we are warranted in adding, with great ability. No one can read his XXII.$^{\text{nd}}$ section intelligently, and not admire his inventiveness. The same mode of treating the subject is carried through his third part, wherein he proposes to determine the arbitrary constants that enter ϕx, so as to make the equation in y solvible, when $m = 5$, or when $m = 6$. In the former case he reduces it to De Moivre's solvible form $y^5 + b y^3 + \frac{1}{5} b^2 y + e = 0$: in the latter, by exterminating the odd powers, he makes the equation virtually of the third degree. All this is likewise satisfactory. But it remains to inquire whether when y is known, the equation $X = 0$ and $(\phi x - y) = 0$, lead to the determination of the factors of X, by means of equations of lower dimensions than X. And here we fail, if $(\phi x - y)$ is an algebraic multiple of X. Indeed, since $\alpha \beta \gamma \ldots \lambda$ are unlimited in number, and are arbitrarily taken from the series 0, 1, 2, 3 . . . .; it seems the height of improbability, that in the case of a given function X, this result should *always* recur. Mr. J., however, has not entered into the disproof: and as far as we have been able to follow the question, it is not to be managed in very few words. In Part IV.$^{\text{th}}$ we shall look for it.

We have said nothing on Mr. J.'s notation for symmetric *factors*, and on the new symbol σ. The truth is, that all this was unnecessary for the immediate object of the three parts already published; and while we admire his aptitude and ingenuity in this matter, we apprehend the book is hereby made less readable. But, (to judge by the specimen in a long note, pp. 56—59), when he gives us the rest of his interesting speculations on the symmetric functions, we shall not complain that his σ is

useless. It is but due, before dismissing the subject, to express our obligations to the type founder and printer, for the clearness and accuracy with which the book is struck off; which is peculiarly creditable, where, from the numerous indices and accents in different positions, misprints are so difficult to avoid.

Outlines of Comparative Anatomy. By R. E. Grant, M.D., F.R.S.Ed., &c. Part I. 8*vo. pp.* 144, *with sixty-five wood cuts.* 1835. London, Balliere. Bristol, Hardwick. (To be completed in four parts.)

The fasciculus before us, describes the osseous, ligamentous, and a part of the muscular system of animals.

The osseous system is traced up from the transparent plates of the lower infusorial animalcules, through the horny zoophytes, or keratophytes,—in some of which the skeleton forms a tubular sheath, enveloping the fleshy substance through all the ramifications of the body,—and the calcareous zoophytes, as the corals, etc.—in which the skeleton becomes stronger, and is for the most part internal and in a single piece,—to the external case or crust of the star fish, urchin, and other echinodermata; and thence through the insects, crustacea, etc. to the vertebrated animals. The osteology of each order is illustrated by a wood cut, and in the skeletons of the higher animals, the several bones are numbered, and their use, and mode of action clearly exhibited.

The two first sections contain a great deal of original and very curious matter, concerning the organization of the horny zoophytes, (sponges, etc.) the manner in which they are nourished, and the double system of pores with which they are provided. Dr. Grant observes, that the abundance of spicular silicious crystals contained in the skeletons of the lowest of the poriphera, is likely to have assisted in their conversion into flint, where their remains have been exposed for ages in chalk or other strata, traversed by silicifying percolations.

The observations upon the osseous system of the vertebrata are worthy of all attention, since they present, in a very intelligible manner, some of those anatomical views now generally adopted on the continent, and in some measure among anatomists in England. We may particularly instance the analysis of a vertebra, the elements of which are delineated, together with some of the most striking of the modifications which they undergo in different animals.

To judge from the specimen before us, Dr. Grant's book seems likely to prove a valuable one. Its details are minute without being tedious, and the style employed is concise without being obscure. Our plan does not permit us here to enter at any length into its contents, which however we have studied with attention, and we feel the more desirous of recommending the work to our non-anatomical readers, because it will enable them to do justice to the zoological articles in this journal, and successfully to attack some of those "terribly hard names," of the use of which many of our most valuable friends so pathetically complain.

Elémens de Zoologie, etc. Par M. H. Milne-Edwards. 2 *vols.* 8*vo. with cuts.* 1834. Paris, Crochard; Bristol, Hardwick.

Of these two volumes, the first contains a general introduction to Zoology; the second, a detailed account of the class mammalia.

The first volume, after preliminary observations upon elementary tissues, considers the great nutritive fluid, the blood, the organs of circulation, absorption, exhalation, respiration, digestion, and their functions, the whole occupying about half the volume. Then follow the nervous system and the organs of the senses, commencing with the integument, that of tact, and concluding with the eye. Observations on the intellectual faculties, on motion, on the voice, and on reproduction, complete this volume.

The second volume, on the descriptive zoology of the mammalia, takes a comprehensive view of the relations and importance of that class. The observations upon the physiology of nations, and upon such points of statistics and political œconomy as appertain to the subject, are interesting and well drawn up, as are those upon the stature of the human race, deduced from the researches of M. Quételet, in Belgium, from which it appears, that the height of the new-born infant is about one fourteenth of its future stature; and that a male child, at the age of three years, has attained rather above half his growth. The tabular contrivance for exhibiting these points is ingenious, and answers its end.

The map shaded according to the production of horses in the different departments of France, and the accompanying aperçu given of the natural history of that very useful animal, forms a section especially interesting to agricultural readers. It appears that by far the great proportion of French horses, are from the departments of the north.

The observations on the œconomical uses of the cetacea, occurring at the end of the volume, are important.

The whale fishery, as our readers are probably aware, has long been carried on in both the northern and the southern seas. In the southern, the fishery of which was commenced by American fishermen from Massachusetts, early in the eighteenth century, are included the waters around Cape de Verd, along the south-western shores of Africa, and those of Brazil and Paraguay, to the Falkland isles, besides which the seas of Japan, of the Sandwich isles, the Marquesas and Gallapagos, have been fished by British vessels, in favourable seasons, with success. The northern fishery is of far older date, and though the smaller in geographical extent, by far the most productive. The fishery of the north employs about one hundred and fifty English vessels; that of the south, about fifty or sixty. In 1830, the products of the two fisheries were valued at £114,416; and in 1831, in Davis's Straits and Baffin's Bay, were taken three hundred and thirty whales; and the seventy-five vessels employed, returned home laden with 4,100 tuns of oil, and 400 quintals of whalebone. And in the same year, twelve whalers on the seas of Greenland, captured eighty-six whales

and four thousand one hundred seals, and returned with 700 tuns of oil, and 600 quintals of whalebone.

Throughout, these volumes are plentifully illustrated, and at the head of each section of the second, is a wood-cut, either of the animal to be described, or of his dental system, or of any important peculiarities which he may present.

The descriptions throughout are free from unnecessary technicalities, and calculated to be understood even by those who have not made the subject a part of their previous studies.

A History of British Fishes. By W. Yarrell, F.L.S. Part I. 8vo. pp. 48. London, Van Voorst.

This is a work on British Fishes, similar in its plan to the celebrated volumes of Bewick upon the Birds. Each species is illustrated by a wood-cut; and to the descriptions are appended vignettes, representing the head, scales, air bladder, or some other peculiarities for which the species may be remarkable.

The general arrangement followed is that of Cuvier; but the author has availed himself also of the recent observations of Agassiz, besides incorporating into the work a very large proportion of original information. We must necessarily defer, until a larger portion of the work shall be completed, any regular observations upon it.

The book will bind up uniformly with Bewick's Birds, and, if the future parts equal that which is before us, will be far superior to Bewick in point of scientific description, and will equal him in the execution of the cuts, if not in the humour of the vignettes.

Relation between Crime and Instruction.

Essai sur la Statistique Morale de la France, par A. M. Guerry, 4to. pp. 70. Paris, Crochard; Bristol, Hardwick.

It is a strong evidence of the increased accuracy of the present age, that many subjects, hitherto treated of in a loose and inconclusive manner, are now brought to the test of observation; so that where formerly we had a moral essay, we now have a numerical demonstration.

Statistics have already been applied to the solution of several high political problems,—criminal legislation, the laws governing the increase of population, the estimation of the wealth, agricultural and commercial, of nations, have thus been approached; but to the enumeration and classification of human actions, and above all, to the appreciation of the motives which led to them, this advantageous method has hitherto scarcely been supposed applicable, or at least has not to any great extent been applied, before the appearance of this volume. The contents are divided into an

exposition of the state of crime in France, and the state of education; and the moral and intellectual condition of each department is exhibited at once to the eye, by means of a series of tabular returns and of maps; in which latter, each department is shaded according to its proportion of crime and ignorance; and thus, by giving "form and shape to that which would otherwise be only an abstract idea," knowledge, of rather an intricate character, is rendered easy of acquirement.

The calculations with respect to crime, are based upon the number of persons *accused*, as representing more exactly the number of crimes committed, than those deduced from such only as are *condemned*, for in every criminal accusation, it is at least highly probable that a crime has been committed.

Although it be not just to consider *every* crime committed in a district, as indicative of the immorality of that district, yet it appears that out of a hundred accused persons, about seventy-two do belong, by birth or residence, to the district in which the crime was committed.

Considering crimes as directed against persons, and against property, it appears that, during the six years ending with 1830, the former amounted to rather above a quarter of the whole.

With respect to the sex of the criminal, it appears that of one hundred crimes against persons, eighty-six are committed by men, fourteen by women; and of the same number committed against property, seventy-nine are by men, and twenty-one by women.

Notwithstanding this disproportion, there does not seem to be any reason for considering men as more disposed to crime than women; for there are very many offences, such as violent homicide, rebellion, forgery, &c. to the commission of which females are but rarely tempted; while in those crimes, the commission of which is equally facile to both sexes, such as poisoning, the unfavourable proportion, according to the cases cited by M. Guerry, is certainly not on the side of the men.

It appears that the maximum of crime is committed between the ages of twenty-five and thirty years. The period commencing and terminating, perhaps, a little earlier among the females. M. Guerry exhibits also, in a tabular form, the crimes to which individuals at certain periods of life are prone, and the influence exercised by the seasons upon many kinds of crime.

Among the incentives to commit crimes against persons, hatred and revenge are the most prominent.

The correspondence between the returns of different years is very remarkable, and shews the permanent dependence which may be placed upon such documents, as data for future calculations.

M. Guerry divides France into five principal regions, north, south, east, west, and central.

The table annexed, constructed from his work, exhibits in the first column the region; in the second, the proportion of honest persons, to one

accused of crime against persons, in each region; in the third, a similar proportion with respect to crimes against property; in the fourth, the number out of a hundred young conscripts drawn from each region, who can read and write; in the fifth, the number out of a hundred accused criminals who who can read and write; and in the sixth, the proportional distribution throughout the regions out of a hundred annual suicides.

REGION.	*Proportion accused of Crimes against*		*Proportion who can read and write in one hundred*		*Distribution of one hundred annual*
	PERSONS.	PROPERTY.	CONSCRIPTS.	CRIMINALS.	SUICIDES.
North ..	1, in .. 19,964	1, in .. 3,984	52	47	51
South ..	,, 11,003	,, 7,534	33	29	11
East....	,, 17,349	,, 6,949	53	52	16
West ..	,, 20,984	,, 7,945	27	26	13
Centre..	,, 22,168	,, 8,265	25	24	9

From this table, it appears that the least criminal region is the central; and the next the western; and that these two districts are also the most ignorant; while the northern and southern,—regions the best instructed,—are also those the most prolific in crime. The fourth and fifth columns shew that the proportion of criminals who can read and write, is very nearly indeed as great as in an equal number of honest men.

These are startling facts, and as M. Guerry justly observes, diametrically opposed to the prevalent modern opinions upon the effects of instruction.

But this conclusion is not confined to France. Similar results, as far as can be judged, have been arrived at in England, Germany, and the United States, and are gradually inculcating the conviction, that however beneficial habits of industry may be to the improvement of morality, to check demoralization it is not sufficient merely to found schools, but that we must look deeper for a remedy to counteract this evil.

Instruction, as M. Guerry philosophically observes, is an instrument of which a good or bad use may be made; that given in the elementary schools of France, consisting only in the teaching, and in a very imperfect manner, reading, writing, and arithmetic, can never supply the want of education, and can scarcely exercise any great influence on morality; he is of opinion that it renders the pupils neither worse nor better, nor is it easy to comprehend how " the teaching a man to perform certain, almost mechanical operations, can suffice to give him regular habits, or develop in him the sentiments of honour and probity."

With these words of M. Guerry we cannot but entirely concur. In this country much interest is felt upon the subject, but we are very deficient in accurate information. Should, however, our government ever attach the

same importance to statistics with those of France, Germany, and Prussia, the data for the decision of the question would be, from the attention paid to religious instruction, very ample; and, we are inclined to believe, would exhibit the important difference between the effects of *instruction* and the benefits of *education,* meaning, by instruction, the teaching the ordinary branches of knowledge; by education, a similar process, but with the important addition of religion.

The returns touching the crime of suicide, with which M. Guerry concludes his volume, are full of interest; its prevalence, in the different regions, has been already pointed out. Suicide is found relatively to increase, as we approach nearer to any of the great cities of France; and it is a remarkable fact, that in proportion as attempts upon the lives of others are common, self-destruction is rare; and the contrary.

M. Guerry has added a list, in the order of their frequency, of the motives by which suicides have been incited to commit the act, and of their last sentiments, both gathered from the papers left behind them.

Among the causes which incite to suicide, it appears, contrary to the usual opinion, that lotteries are not among the chief. The passion for the lottery does not produce that sudden and unforeseen ruin which urges men to desperation; it only cripples their resources, accustoms them to severe privations, and after having destroyed their characters, reduces them to subsist upon public charity. Gambling, on the contrary, produces effects far more deadly.

We cannot but recommend the observations of M. Guerry, and the few reflections in which he indulges, to the serious attention of our readers. The subjects of which he treats are of great importance to this country, in which political power has been placed in hands not too well qualified to use it beneficially. Public attention is awakening to the subject, but we have few means of forming any just conclusions. M. Guerry has executed his task concisely and clearly; and we indulge in a hope, that, in this country, the materials for a similar work will be collected, which indeed might be rendered far more interesting, if the returns of the different charitable societies were added to it.

Notice of Colonel Jackson's "Hints on Geographical Arrangement and Nomenclature." Transactions of the Royal Geographical Society. Vol. IV. Art. V.

Considering the evils which have befallen every important branch of natural science, from the want of clearly defined terms and well-arranged systems of nomenclature, as well as from the ill-contrived and patched-up methods which have gradually prevailed in their stead, we are glad to take advantage of the appearance of Col. Jackson's paper, to lay the substance of his remarks before our readers; and we do this the more readily, that

we are led to expect, from our friends in South America and the West Indies, both geographical and geological communications, in which we are very desirous that some intelligible system of nomenclature should be adopted.

How much may be done, both in science and art, by a strict attention to the signification of words, independently of, or with but little aid from diagrams, the existing systems of Zoology and Botany, and the treatise of Mr. Rickman, and the Hints of Professor Whewel, upon English and German Architecture, amply evince. No student need dread a well-conducted, what may be called a conservative reform, in the nomenclature of his pursuit; for although it is true that the zeal of one or two leading naturalists has led them rather to obscure with hard names, the sciences which in other respects they have elucidated, yet by far the grossest abuses of this nature have arisen from the expansion of a science, without a corresponding expansion of its nomenclature; by which means, new facts are left to be designated by old terms, and an obscure and indefinite system of synonymes is introduced, utterly incapable of any thing like accurate employment, and any attempt to patch up which, is likely only to make confusion worse confounded.

We do not mean to say, that in remodelling the nomenclature of a science, every old term is to be swept away, and a set of entirely new ones introduced, this would be absurd. The obvious method of proceeding will be, to preserve all well-defined terms—unless, as formerly in chemistry, they are founded upon false views of the facts;—to take such other terms as are unobjectionable, but ill-defined, and after strictly limiting their signification, to retain them also; utterly rejecting such only as are absurd, or founded upon misapprehensions of the facts. By such means, many of the advantages of a well-known, will be combined with those of a well-arranged system.

The adoption of a systematic nomenclature in Physical Geography would be of inestimable advantage, both to that science and to Geology, as it would enable a clear-headed traveller to give a more intelligible description of a country, or of a mountain chain, in a few lines, than he is now able to do in as many pages; not to mention that the substitution of strictly defined words for others of no meaning at all, would, as a contingent advantage, strike at the very root of the intolerable practice of book making.

The two principal features in the Physical Geography of a country, are its mountains and its rivers; and before a country can be considered as well described, geographically, the general distribution of these must be understood and explained; and if once this be well done with respect to these great outlines, the task of filling up the details will be comparatively light, and when once learned they are not very likely to be forgotten.

Col. Jackson considers, first, the incompetency of the present system, both in this country and in France; and offers, secondly, the principles of

the system which he proposes to substitute in its place. He commences with the rivers, to which we shall, on the present occasion, confine our remarks. The disposition of a large stream from its embouchure upon the sea, to its sources, has been compared to that of a tree: the divergences at its delta are the *roots;* the grand stream is the *trunk;* the waters immediately tributary to it are the *branches;* the direct tributaries to the branches are the *twigs;* and finally, the streamlets subordinate to these, represent the *terminal fibres* and *tendrils.*

Now to denominate these four orders of ramifications, each of which is "*affluent*" before, and "*confluent*" after falling into its recipient, we have in French three, and in English but two names. "*Fleuve*" is "a great river, passing from its source to the sea under the same appellation;"—an arbitrary and absurd limitation. "*Riviere*" is "a current falling into a river, and of size sufficient to carry a boat." A "boat" is an indefinite term, and may mean any thing, from a canoe to a large Nile canjar. A "*Ruisseau*" is "a little current of water."

In English the provision is still less adequate, as we have only the terms *river* and *brook;* streamlet and rivulet being synonymous with the latter, and serving only to obscure its meaning.* Stream is a general term for all running waters.

Such definitions are obviously of but little value. But there is an objection, which we shall presently state, of far greater importance, to the principles upon which they rest.

There are two principles upon which the classification of rivers might be founded. The one, upon their relative length, breadth, depth, or volume of water; the other upon the number of their orders of ramifications.

Col. Jackson considers the first of these to be almost impracticable, since, although rivers vary very considerably in length, breadth, depth, etc., as well as in the dimensions of the hydrographical basin or district which they drain, yet these graduate into one another much too imperceptibly to admit of distinctions, there being no pause between the Amazon and Mississipi, and the Thames and Humber. The Thames, with a course of 250 miles, would under such a system, be just as much a *Fleuve* as the Mississipi, whose course is stated at 3,700; and the diminutive Isis just as much a *Riviere* as the Ohio, which falls into the Mississipi.

The second system, although Col. Jackson considers it as on the whole the best, is obnoxious to very serious objections. In the first place, the amount of its orders of ramifications, conveys imperfect information respecting the *absolute* size of the stream. Much depends upon the sort of country through which a river flows. Thus the Severn winds away from

* "River—a land current of water, bigger than a brook." "Brook—a running water, less than a river."—Johnson. Mr. Locke calls the terminals of rivulets, "Springs."

Tewkesbury to Aust, receiving no branch thought worthy of a name in the map; and the Wye runs up to Monmouth, without receiving any branch at all. While many of the smaller rivers, as the Taafe or Parrot, commence their ramifications almost at their mouth, the Nile receives only one tributary below its bifurcation in Ethiopia. These, however, it seems, are to be considered as exceptions, for Colonel Jackson states, though without proving it, that, generally speaking, the largest rivers are those which have most orders of ramifications.

If, then, there be a natural correspondence between the size of a stream and the orders of its ramifications, one great step towards classification may be considered as gained.

There remains another, but, in Col. Jackson's opinion, a minor difficulty. How is the main stream to be invariably distinguished from its affluent tributary, or the continued course of a first, from the influx of a ramification of the second order? How are we to determine whether the Tame or the Isis be the continued line of the Thames, or to which of the great branches of the Nile the name of that river should be given? With respect to the geography of the old world, custom has already decided such points. In Southern America, where are many large streams yet unnamed, we learn that the difficulty is still felt, nor does Col. Jackson, in pointing it out, suggest any remedy. It is obvious that where this difficulty exists, it may cause a stream to be described by one traveller as composed of four or five orders of ramifications, and by another as of only one, according as one or another line be considered as the continuation of the principal stream.

This difficulty, however, is one that time must gradually diminish, and at no very distant period altogether remove; so that on the whole, Col. Jackson is of opinion that the classification of rivers by their ramifications, seems to be that system most likely to be generally practicable.

Col. Jackson divides streams under five classes, since the very largest are not found to possess more than five orders of ramifications. The current falling immediately into the sea, he calls the *primary recipient.*

River islands are divided by Col. Jackson into two classes; *Branch* islands, or those formed by the anastamosing branches of a river; and *Channel* islands, or such as are not formed by any branching off of the river, but are found in its regular channel. Among branch islands are those formed in deltas, or *deltoid* islands.

Of channel islands we have *Bed*-islands, or those formed of the same material with the bed and banks of the river; and *Bank*-islands, which are later deposits, brought down and left by the stream. When such a deposit is below the level of the water, it is called simply a *Bank.*

The *Bed* of a stream is the excavation which it usually occupies, and over which it flows; the term *Channel* being limited to its deepest part.

With respect to the sides of a stream, Col. Jackson terms the heights at

a little distance from it, but which appear to have once been its immediate limit, the *Bergs*. The term *Banks* he confines to the lateral limits of the stream, actually washed by its waters; the *Border* is the ground immediately above the water's edge. The *Brink* is the actual edge of the stream, and the *Margin* that space, often of considerable extent, between the berg and the brink.

These terms, many of which we shall have occasion to make use of in our future geological descriptions, will be best understood by a few local examples.

The Severn is a stream of at the least three orders of ramifications, that is, of the third class. Its primary recipient, after a course generally south-westerly, of from 250 to 300 miles, falls into the Bristol Channel. Its principal ramifications of the first order are, on the north, the *Neath*, the *Taafe*, the *Rhymny*, the *Usk*, and the *Wye*; on the south, the *Parrot*, the *Brue*, the *Axe*, the *Yeo*, the *Avon*, (Bristol,) and the *Avon*, (Worcestershire). Of these, many of the second order of ramifications are not named, even in the best maps: the *Taafe* receives the *Ely* and the *Lesser Taafe*, the *Avon*, the *Froom* and the *Boyd*, whose subordinate ramifications are not named.

The exact embouchure of the Severn is undetermined; its breadth at the influx of the Avon is about five miles; its main channel depth at low water, about forty feet; and its length, from its origin on Plinlimmon to this point, about 250 or 300 miles. Its current is rapid, and its tide-rise, flowing to Upton, about seven feet. It is navigable for barges of fifty tons, and drawing three foot water, as high as Welshpool.

At Gloucester is a *branch*-island, formed by the separation and anastomosis of two branches of the stream; and lower down are several *channel*-islands, of which the Denny and the Chapel rock are *bed*-islands. The mouth of the river is studded with *banks*. At the mouth of the Avon is the Swash, a deltoid *bank*-island.

The *bed* of the Severn is chiefly rocky, though covered in many parts with alluvial mud, to the depth of twenty or thirty feet. The *channel* is very irregular, and much intersected by *banks*.

The *bergs* of the Severn are lofty ranges of hills, occasionally at a distance of eight or nine miles from the stream; near Bristol they are formed by the ranges of Thornbury, Kingsweston, and Clevedon, and on the opposite side by the corresponding ranges of Monmouth and Glamorgan. The *margins* are entirely flat and alluvial, lying about two or three feet above high water. The *banks* are for the most part muddy, except where the rock crops out, or an occasional beach of shingle is thrown up. The *border* forms a low cliff, about six feet in height, fringed with a layer of scanty reeds and grass, and alternately encroached upon by the stream, or added to by the muddy deposits from its waters.

Such are some of the principal points laid down by Col. Jackson, towards

the geographical nomenclature of streams. Of the importance of the subject we are well aware, and think it not improbable that it may receive some advancement from the study of the streams falling into the neighbouring channel; in aid of which, the excellent ordnance maps for a square of seventy-two miles, with Bristol as a centre, now at the Institution, may be consulted with advantage.

We regret that our limits do not permit us to go even more at length into Col. Jackson's paper; which, although in some parts open to considerable, if not to insurmountable objections, is deserving of all attention. Those who feel interested upon the subject, will find it treated at length in the last number but one of the Geographical Transactions, where also they will find a "Journal of a Voyage up the Massarooney, in 1831;" the substance of which was originally read before the Bristol Philosophical Society, at the desire of Mr. Hilhouse, of Demerara, its author.

QUARTERLY HORTICULTURAL REPORT.

Rhododendron Arboreum, or, *Scarlet Tree Rhododendron,* occurs over the mountains of Nipal, where it attains the size of a large forest tree. In this country, though of more diminutive growth, it is as great an acquisition to our gardens as any plant with which we are acquainted, not only from its grand appearance, it producing large heads of flowers of the most intense scarlet hue, but on account of the variety and beauty of the hybrids which have been produced from seed between it and others of the same family, such more particularly as *Rhododendron Cataubiense, R. Maximum,* and *R. Caucasicum. R. Arboreum* will not flourish in our grounds, except in very sheltered situations; it has been tried in the Bristol Nursery, but without success. It is itself a conservatory plant, but the seedlings, produced between it and any of the hardy species or varieties, are perfectly hardy. At this time a splendid plant, which was raised from seed saved from *R. Arboreum,* fertilized by *R. Maximum,* is in high perfection at the nursery, and has from forty to fifty large heads of blossom, of a rich crimson. This plant has been out in the American border for these last four years, and has grown luxuriantly. We have also had another fine variety, produced from seed between *R. Arboreum* and *R. Caucasicum,* which has flowered this season; its flowers were large and fine; and what appears extraordinary, it had two distinct heads of flowers, differing in colour; the one being a bright rose, and the other almost white. This singular lusus we have never before observed in this tribe, although it frequently occurs in the *Camelia* and many tribes of plants.

Camelia Reticulata came into this country from China in 1822, but is not yet common. This fine and very distinct species produces the largest

flowers of the whole genus, somewhat resembling those of the rose-coloured pæony. They measure between five and six inches across, and appear to be as hardy as the varieties of *Camelia Japonica;* but in consequence of its scarcity, we have not yet risked it in the open ground.

Amongst numerous varieties of *Japonica* that have bloomed with us this season, the following are most deserving of notice.—Camelia Milleri, a seedling raised at the nursery, has for the first time bloomed in perfection, and is worthy a place in every collection of plants. Its flowers are double, and of a fine shape, compared with many other seedling varieties; they are also of a livelier red than any other we have yet seen. Its foliage is fine, and much resembles that of *Chandleri,* a well-known variety. We have also had this season in bloom, *C. J. Corallina, Althæiflora, Grey's Invincible,* or *Punctata, Press's Eclipse, Colvilii, Imbricata tricolor, Rosa-Linensis, Ignescens,* and a fine large *Double white,* which is planted out at the west end of one of the houses. This superb plant, which has at this time upwards of five hundred buds and flowers on it, was placed out in the year 1826; and has had no protection except when in flower, a proof of its hardiness. I once noticed the thermometer at a few paces from it, as low as 10°; so that the plant sustained 22 degrees of frost without injury, the leaves only drooping as those of other evergreens when frozen. I have no doubt but that all the varieties of *Japonica* will succeed out of doors, with little or no protection, and that we shall at no distant period see them as plentiful in our gardens as the admired *Pyrus Japonica.*

Amongst the stove Orchideæ, the undermentioned are now in bloom:—*Cyrtopodium Andersonii, Dendrobium Pierardi, Oncidium luridum, Oncidium Carthaginense, Bletia Florida, Calanthe veratrifolia,* and a very curious, and we believe, an undescribed species of *Catasetum,* which, with about thirty other of the *Orchideous* tribe, was presented to Mr. Miller by Mr. S. Stutchbury, having been collected by his brother in Demerara: many of these appear to be quite new to us.

Amongst other green-house plants in bloom, is a new and beautiful species of the Epacris tribe, viz. Epacris Impressa. The general varieties of the tribe of Cactus, Mimulus, Calceolaria, and Pelargonium, bid fair to flower in profusion. And owing to the mildness of the winter, the plants in the borders are starting into renewed vegetation; and the hyacinths, auriculas, and polyanthuses, are far advanced into bloom.

M. Mayes.

Bristol Nursery, March 26, 1835.

METEOROLOGICAL TABLE,

For the months of JANUARY, FEBRUARY, *and* MARCH, 1835, *kept on Nine-tree Hill, Kingsdown, Bristol.*

Jan.	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	30·07	48	25		N.	Cloudy
2	·60	38	28		N. E.	Fine
3	·58	42	25		E.	Cloudy
4	·46	36	26		N.	Fine
5	·42	36	29		N. E.	Fair
6	·39	35	23		E.	Cloudy
7	·14	28	24		E.	Ditto
8	29·99	39	25	0·03	E.	Ditto with light Rain
9	·74	49	35	0·08	S. W.	Cloudy A.M. Rain P.M.
10	·75	50	38	0·03	S. W.	Fine, A.M. Rain, P.M.
11	·61	52	46	0·05	S. W.	Drizling
12	·76	52	38		S. W.	Fair
13	·50	47	40		E.	Cloudy
14	·32	50	36	0·04	S. E.	Cloudy, with Rain.
15	·56	51	40	0·27	S. W.	Squally.
16	28·86	51	31	0·11	W.	Stormy, A.M. Fine P.M.
17	29·53	40	25		W.	Fine
18	·57	39	33	0·38	N. E.	Fair. Squally Night.
19	·02	39	27	0·06	N. W.	Squally, with Snow.
20	·95	32	16		N.	Fine
21	30·20	36	24	0·18	N.	Hazy. Snow, P. M.
22	·08	42	34		N. W.	Fine A.M. Cloudy P.M.
23	·22	47	37	0·03	W.	Fair. Rain at night
24	·03	50	40		W.	Fair
25	·10	51	46		W.	Ditto
26	·21	51	43		W.	Hazy
27	·27	51	42		S. W.	Cloudy
28	·17	47	43		S. W.	Ditto
29	·02	53	40		S. W.	Ditto
30	29·92	49	39		S.	Fair
31	·82	50	40		S. E.	Ditto

Feb.	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	30·05	55	49	0·08	S.	Cloudy. Rain, P. M.
2	·03	55	41	0·21	S. W.	Rain
3	·26	54	39		W.	Cloudy
4	·35	52	41	0·01	W.	Fine. Rain at night
5	·15	51	36	0·02	W.	Squally
6	·14	45	39		N. W.	Fine
7	29·98	51	36	0·18	W.	Squally, with Rain
8	·64	48	33	0·02	W.	Squally, with Hail
9	·87	43	30	0·01	N. W.	Ditto
10	30·10	37	25		N.	Fine
11	·28	47	38	0·27	S. W.	Cloudy. Rain at night
12	·03	49	37	0·08	W.	Rain, A.M. Fine, P.M.
13	·25	51	43	0·11	N. W.	Cloudy A.M. Rain P.M.
14	29·93	55	44		W.	Fair
15	·57	53	39	0·15	W.	Fair. Rain at night
16	·52	49	39	0·02	W.	Ditto Ditto
17	·62	44	39	0·20	W.	Ditto Ditto
18	·32	47	35	0·10	W.	Fine. Lightning, P.M.
19	·31	48	33	1·15	S. W.	Stormy
20	·14	47	31	0·39	S. W.	Hail and Rain
21	·19	44	33	0·05	S. W.	Squally, with Hail
22	·60	49	42	0·33	S. W.	Rain
23	·29	50	32		W.	Squally. Fine, P. M.
24	·70	47	37	0·09	W.	Fine. Rain at night
25	·30	52	40	0·45	S. W.	Stormy
26	·23	53	36	0·15	S. W.	Changeable. Lightng.
27	·12	51	35	0·03	S. W.	Rain
28	·70	43	32	0·27	N. W.	Fine. Rain at night

Mar	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·21	45	29	0·04	N. W.	Rain. Squally, P. M.
2	30·01	48	32		W.	Fair
3	29·70	48	34		W.	Ditto
4	·73	52	31	0·06	S. W.	Fair. Hail at Night
5	·93	49	38	0·25	W.	Fine. Stormy Night
6	·39	50	38	0·39	N. W.	Stormy A.M. Fine P.M.
7	28·74	50	32	0·12	S. W.	Rain
8	29·74	48	37	0·11	W.	Fine. Rain at Night
9	28·96	53	29	0·28	S.	Changeable
10	29·43	52	38	0·68	W.	Stormy, with Hail
11	·36	55	39	0·28	S. W.	Rain, A.M. Fine, P.M.
12	·56	47	31	0·45	N. E.	Ditto Ditto
13	30·04	50	35	0·34	S. W.	Fine. Rain at Night
14	29·83	58	46	0·20	S. W.	Rain, A.M. Fine, P.M.
15	·80	52	38	0·08	N. W.	Ditto Ditto
16	·99	51	43	0·06	W.	Rain A.M. Cloudy P.M.
17	·70	54	40	0·01	S. W.	Changeable
18	·88	50	32		N.	Fair
19	30·10	53	37		N.	Fine
20	·16	58	46	0·03	S. W.	Cloudy. Rain, P. M.
21	·13	61	46	0·02	W.	Ditto Ditto
22	·11	51	34		N. E.	Cloudy
23	·14	49	38		N. E.	Ditto
24	·18	48	29		N. E.	Ditto
25	·42	47	28		N. E.	Fine
26	·34	49	31		N. E.	Ditto
27	·18	54	37		N. E.	Fair
28	·08	47	29		N. E.	Cloudy
29	29·94	51	29		E.	Fair
30	·75	54	38		Vrble.	Ditto
31	·65	58	48	0·39	S.	Rain

The mode of taking the observations is as follows:—The Barometer (with an open eistern) is noted every morning at nine o'elock, and its height placed opposite to the day of the month; but the Thermometer and Pluviometer, which are also examined at the same time, have their results recorded opposite to the date of the day preceding, consequently they apply to a period of twenty-four hours, beginning at nine, A. M. on the day indicated. The Wind is noted by observations on the highest and best vanes of the churches in the city; and when more than one direction is observed during the day, the word Variable is used. The Weather noted is the general character of the day.

Small Street, Bristol.

EDWARD JONES.

DONATIONS

TO THE

BRISTOL PHILOSOPHICAL AND LITERARY INSTITUTION,

Since January 1st, 1835.

MAMMALIA.

Captain Rees, *Ship Eleanor.*—Specimen of the Brown Coati, (Nasua fusca,) Demerara.

Dr. Riley.—Common Baboon, (Cynocephalus.)

E. Cross, Esq., *Surry Zoological Gardens.*—The Black Coaita, or Spider Monkey, (Ateles Paniscus,) South America.

BIRDS.

Capt. T. Brown, *Ship Ann.*—Two Ring-Doves, (alive,) from Alexandria.

Sir Charles Forbes, per J. King, Esq.—Albatrosse, (Diomedia Exulans).

Richard Smith, Esq.—Two small Finches, from the Cape of Good Hope.

Mr. Glover.—Scarlet Ibis, (Tantalus ruber) ; Spoonbill, (Platalea ajaja) ; Boatbill, (Caneroma cochlearia) ; Toucan, (Rhamphastos tucanus) ; and another bird ; all from Demerara.

John Miller, Esq.—A fine specimen of the Curassow Bird, (Crax alector).

REPTILES.

Miss Grant, *Clifton.*—Various Reptiles, among them the *Cobra de Capello,* and five other snakes, from Trincomalee ; *Iguana tuberculata,* St. Vincents.

Captain Ratcliffe.—Snake, from Africa.

W. B. Green, Esq.—Two Eggs of a large Tortoise.

CRUSTACEA.

Capt. F. Cundy, *Ship Sybilla.*—A singular Crab, (Parthenopus horridus,) from Mauritius.

INSECTA.

Miss Grant.—Four remarkably large Scorpions, *(Scorpio orientalis,)* from Ceylon; large Spider, from Ditto.

ZOOPHYTES.

Capt. Saunders, *Ship Pearl.*—Numerous specimens of Madrepora muricata, Prolifera, and Abratanoides; Pocillopora damicornis, acuta, and solida.

Mr. H. Stutchbury.—Forty specimens of various Stony Corals, most of them named according to de Blainville's new system d'Actinologie.

Mr. Samuel Stutchbury.—A specimen of a dense species of Astrea, grown upon an old porter bottle, picked up in Port Royal, Jamaica; also, a specimen of Pavonia boletiformis, enclosing an Ostrea, from Tahiti.

OSTEOLOGY.

Sir Charles Forbes.—Jaw of a Shark, and the Skull of a Porpoise.

E. Cross, Esq., *Surry Zoological Gardens.*—A fine large Leopard, *(Felis Leopardus)*; Black Coaiti Monkey, *(Ateles paniscus,)* for skeletons.

Mr. Coulstring.—Newfoundland Dog, for skeleton.

MOLLUSCA.

Mrs. Griffiths.—Aphysia viridis of Bosc; the Acteon aphysiformis of De Ferrusac, from Torquay.

S. P. Pratt, Esq.—Unio alatus, N. America; Byssus of Pinna nobilis, Mediterranean; Terebellum; animal in spirit, external tube dry.

Captain Ratcliffe.—Cymba porcina, from Africa. Twenty-five species of British Shells, namely, Scalpellum vulgare, Balanus punctatus, Pholas candida, P. papyracea, P. lamellata, P. parva, P. hians, Solen vagina, S. pellucidus, Gastrochæna dubia, Lutraria compressa, L. oblonga, Cardium tuberculatum, C. echinatum, C. aculeatum, Isocardia Cor, Venus ornata, V. reflexa, Amphidesma Boysii, Anatina intermedia, A. distorta, Petricola irus, Nucula margaritica, Pecten varius, Pinna nigens, with its byssus.

Wm. Sanders, Esq.—Byssus of Pinna nobilis.

GEOLOGY.

The Very Rev. Dr. Beeke, *Dean of Bristol.*—Three specimens of a fossil animal, allied to the Orthoceratite, but evidently of a tegumentary rather

than of a testaceous form :—Petit Tor, or Babbacombe. Eight specimens of Spirifera, shewing internal spiral apparatus, from Limestone; Meadfoot Sands, Torquay. Ten portions of Crinital column, from Ditto. Nine various Fossil Corals, from Ditto. A fine Ichthyodorulite.

John Miller, Esq.—Specimen of Fossil Wood, from Allersley, near Coventry.

Council of the Philosophical Institution, Leeds.—Two Casts, one of the Head, and the other of another portion of an undescribed Fish, from the coal formation of Yorkshire.

MINERALOGY.

Henry Bush, Esq.—A specimen of Crystallized Sulphate of Strontian, and three ditto of Crystallized Native Sulphur, from Sicily. Two specimens of Crystallized Murio-arseniate of Lead, from Cumberland; two ditto of Crystallized Blende, with Pearl and Brown Spar, from ditto; a large and fine Ditto of Crystallized Sulphate of Barytes, with Barytocalcite; and a specimen of Walfram.

W. Pountney, Esq.—A splendid specimen of Crystallized Soda.

COINS.

W. P. King, Esq.—One hundred various provincial Copper Tokens.

Capt. James McArthur.—Two Roman Coins, cemented in a dense Breccia, from the bed of the river Thames,—dug up in removing the foundation of the old London Bridge.

MISCELLANIES.

Capt. James McArthur.—A Roman Dagger, found in removing the old London Bridge.

F. J. Rankin, Esq.—A Mat for sleeping upon, and a Stool, from the country of the Jolliffs, Africa.

Mr. Alex. Alexander, *Exeter.*—A newly-invented Graphic Mirror, for drawing from nature, copying, &c.

Capt. Thos. Brown, *Ship Ann.*—A Turkish Firmaun.

BOOKS.

Dr. Robert Thomson.—No. 1, of "Records of General Science," 8vo.

Mrs. Mary Somerville, *London.*—A copy of her work "On the Connection of the Physical Sciences," 8vo. 1835. Second Edition.

John Britton, Esq. *London.*—No. 1, of "Britton and Brayley's History and Description of the late Houses of Parliament, and the Ancient Palatial Edifices of Westminster." 8vo. 1835.

John Dalton, Esq., *Manchester.*—A copy of his Meteorological Observations and Essays; 8vo. 1834.

John Herapath, Esq., *Kensington.*—A copy of his "New Nautical Almanac, for the year 1835." 8vo.

Zoological Society, *London.*—A Copy of their Proceedings, for the years 1830 to 1833, inclusive; and the Numbers from January to May, inclusive, for 1834.

Dr. Michael Faraday, *London.*—Copies of his Papers, entitled, "Experimental Researches in Electricity;" Third, Fourth, Sixth, Seventh, and Eighth Series, published in the Philosophical Transactions.

WEST OF ENGLAND JOURNAL

OF

SCIENCE AND LITERATURE.

No. III. JULY, 1835. Vol. I.

PART I.—SCIENCE.

REFLECTION AND REFRACTION OF LIGHT,

As explained by Newton, Huygens, and a new Theory, in order to form a Comparison.

BY THOMAS EXLEY, A. M.

1. The phænomena of light have always excited curious attention; but optics as a science must have been exceedingly imperfect, before the law of refraction was discovered by Snellius, early in the seventeenth century. And, notwithstanding the recent very brilliant atchievements in this admirable science, refraction and reflection still remain the fundamental properties, which present the true principle and grand instrument, in explaining all known optical facts. These constitute the only key capable of opening the radiant palaces of light. If these be explained satisfactorily, every difficulty will vanish, and we shall proceed in broad day-light, cheerfully enjoying the splendour of our subject.

2. The first philosophical explanation of the important law of refraction, worthy of notice, is due to Huygens, who deduced his conclusions from the theory of undulations, supposed to be propagated in spherical waves, through an universal and highly elastic medium or ether.

To this succeeded Newton's elegant explanation, founded on specific attractions and repulsions, operating at alternate distances between the atoms of light and those of contiguous bodies.

3. Both the explanations are exceedingly ingenious, but both are confessedly defective, for this reason, among others, that they rest on hypothetical principles, which have not been, and certainly never can be verified. The undulatory theory has of late found many admirers, and able supporters. Indeed the facility with which it can, under due modifications, be applied to the solution of many intricate phænomena, relating to diffraction and the polarisation of light, has given it an ascendancy over the Newtonian theory. The general opinion seems to be, that one or other of these must be true. They are called the rival theories. I have ventured, however, in a Treatise on Physical Optics, lately published, to present ex-

planations of all the leading facts in this delightful and extensive science, on different principles, principles already admitted and established in other departments of philosophy.

4. In order to do justice to the subject, and place it fairly before the reader, so as to enable him readily to enter into a view of the cause, or supposed cause of reflection and refraction, according to the three notions in question, it will be proper, or rather necessary, to present a brief statement of the principles on which each system is built.

5. (I.) The Newtonian or corpuscular theory of light requires the following postulates:—

1. That light consists of solid particles having inertia, and some definite magnitude; and that they are projected from self-luminous bodies with nearly equal velocities.

2. That these atoms of light differ from each other in their actual masses or inertia, and in the intensity of their attractive and repulsive forces, and in their relations to other bodies.

3. That these particles, impinging on the eye, excite vision; that the different sorts produce the sensation of different colours, and that they are refracted, some more than others.

4. That there is a mutual action of the particles of light, and those of other bodies, on each other; the actions being alternately attractive and repulsive.

5. That these forces have different absolute values for the different sorts of bodies, of a nature analogous to chemical affinities.

6. That these attractive and repulsive forces, though indefinitely greater than gravitation, are *absolutely insensible* at all measurable or appreciable distances from the particles which exert them; and yet these exceedingly small distances are very large, in comparison with the distances between the particles of the reflecting or refracting media.

7. That every luminous particle during the whole of its progressive motion is continually passing through periodical changes, or alternations, called fits of easy reflection, and easy transmission; being more easily reflected in the former state, and transmitted in the latter. See Sir J. Herschel's *Treatise on Light,* Ency. Metrop. art. 526.

6. (II.) The Huygenian, or undulatory theory, requires, with some others, the following postulates.

1. That an elastic ethereal fluid fills all space, and pervades the interstices of all bodies, having inertia but not gravity; and presenting no observable resistance to the motions of planets and comets.*

* Encke's comet is said to have had its period shortened, an indication that it has suffered some resistance, but if so it may arise from the solar atmosphere affecting it when near the perihelion; for although the gross atmosphere of the earth extends only to an altitude of forty or fifty miles, yet the ethereal matter enveloping it may extend to some hundreds, or even thousands of miles, and that of the sun more in proportion.

2. That the particles of the ether are set in motion by the agitations of ponderable matter, and the communicated motions are propagated to the adjacent ether continually in all directions, according to the laws which regulate undulations excited in other media.

3. That the elasticity of the ether is less in bodies than in spaces void of other matter, and less in bodies which have a greater, than in those which have a less refractive density.

4. That the vibrations of the ether are propagated through bodies by means of the ether in their interior, with a less velocity in bodies which have a greater refractive density.

5. That the vibrations of the ether agitating the nerves of the eye excite vision.

6. That the frequency of the pulses, or the number acting on the eye in a given time, determines the colour; and the extent, or amplitude of the vibrations, determines the intensity or brightness of the light. See Sir J. Herschel's *Treatise on Light*, art. 563.

7. (III.) It remains to exhibit the basis on which the third explanation is founded.

Natural philosophy does not any where inform us what is the connecting link between matter and mind; or in what manner any sort, or state, or situation of matter, serves to produce this or that idea: we can trace its progress to a certain point, but cannot follow it into the chamber of imagery. Hence when we pursue the subject up to sensation, we must rest ultimately on the simple fact, as the limit of our knowledge: the fact however proves an inscrutable connection between mind and matter, established by the power and will of the Creator. Therefore in every system or theory, the sensations of light and of colour must be attributed to the actions of luminous particles, which follow, after we have traced their progress to the organs of vision.

Hence the third principle in the Newtonian, and the fifth in the Huygenian theory must be freely admitted, and similar conclusions must in every case be granted: in respect of the emission and motion of luminous atoms, the present views agree with those of Newton; the great difference is in the constitution of the atoms, which therefore requires a particular explication.

8. According to Newton, these are very minute solids, massy, hard, impenetrable, and moveable; and this notion, although hypothetical, is generally received. Newton does not consider gravity as an essential property of matter, but as a power or virtue appended to every particle. The name indicates a property, but if a property, it necessarily inheres in a substance co-extensive with itself. Of the minute solids and the multitude of attractions and repulsions which have been imagined, we are still more ignorant, we do not know even that they exist; are they not the fictions of fancy? worse than useless in philosophy, unless employed confessedly

as mere hypotheses? I have therefore discarded them, and admit that alone which we know has a real and actual existence, namely, gravitation. Some are startled at this, but if it be found sufficient, why encumber the subject with obstacles, weights, and barriers? Guided then by the influence of correct analysis, we seize this principle, and follow it upward to the celestial regions, and downwards to the centres of atoms; the legitimate and only true rules of philosophizing do not allow us to stop in either direction, while any space is left unexplored. This force, whose effects have guided our inquiries, we find reversed in the immediate vicinity of the centre; this may be called repulsion, because of its opposite direction, but still it is the same force as that of the attraction, being of the same nature, and regulated by the same laws. Hence nature herself leads us by the hand of genuine philosophy to a just notion of matter; and places before us this demand, this postulate, that an atom of matter consists of a system of force, varying inversely as the square of the distance, acting a little way outwardly, or from the centre, and thus forming a sphere of repulsion, but towards the centre, at all greater distances, forming a sphere of attraction. Again, there is nothing to prevent a difference in the absolute forces of different atoms, or in the radii of their spheres of repulsion, and phænomena require these differences; hence nature makes a second demand, viz. that the atoms of matter differ in these respects: and this difference is sufficient to account for the many sorts of matter which come under our review, or indeed ten thousand times greater varieties.

9. Thus, for example, an atom of oxygen has a given absolute force, and radius of its sphere of repulsion; the same may be said of hydrogen; but phænomena indicate that the force of the oxygen is about sixteen times greater than that of hydrogen, while its sphere of repulsion is less. Similarly every different sort of atom has its own peculiar force and sphere of repulsion. In every system we must admit that the materials are duly apportioned; all things are produced according to number, weight, and measure. Now nature points out at least two grand classes of atoms, distinguished by a very great difference in their absolute forces: those which form solid bodies I call tenacious atoms, because we find them adhering with great tenacity,—they constitute common matter; atoms of the other class are called ethereal, because as we observe them, they form collections, or bodies, such as are denominated ethereal fluids.

10. It is manifest that one of the former, being present in a mass of the latter, will attach to its surface of repulsion a vast number of them, closely crowded together: for, to conceive rightly of this, assume the absolute force of oxygen to be three hundred and twenty million times greater than that of an ethereal atom. It is manifest that the oxygen would draw to its surface the centres of the ethereal atoms, till the force between them become nearly equal to that of the oxygen at the same surface; hence the distance between the centres would be about the $\frac{1}{12649}$ part of the radius of the sphere of

repulsion of the oxygen; hence there would rest on the surface a stratum of ethereal atoms, consisting of about two thousand millions. For the same reason other strata would be superposed, forming on the whole an atmospherule about the oxygen, and containing a number of ethereal atoms, to the amount of some millions of millions.*

11. Hence it follows, that to any large body, such as the earth, or a planet, will be attached a dense and extensive atmosphere of ethereal matter, reaching in altitude perhaps many hundred miles, more or less, according to the proportionate quantity, and the mass of the body: also the atoms of the body will be severally invested by atmospherules, and the vacuities or pores will be occupied by the ethereal matter. Hence we see how the gross or common atmosphere may arise as a natural consequence, its nature, altitude, and density, being limited by the quantities and qualities of the two classes of atoms present. It likewise follows, that the surfaces of detached bodies will retain a mass of ethereal matter more dense than in their interior, and still more so at the angular edges and corners. The ethereal matter is admirably suited, and circumstanced, to be projected with immense velocity during chemical combinations, especially when they are energetic; and, when moving with a certain velocity, to excite the nerves of the eye at the seat of vision; hence we conclude, that light is these atoms moving with a due velocity. See the New Theory of Physics, and the Treatise on Physical Optics lately published, in which these subjects are elucidated and applied.

12. The reader will now be prepared to understand the doctrine of reflection and refraction, according to each of the three views, which may, after these preliminaries, be brought into a moderate compass for easier comparison. The facts to be explained are the following:—

1. While in the same medium, light moves in a straight line, at the rate of about 200,000 miles in a second.

* Let t, be the thickness of the atmospherule, r, the radius of the sphere of repulsion, a, the distance between the centers of two ethereal atoms at the surface of the oxygen, and n the number of strata; then, $t = \frac{(r+a)^n - r^n}{r^{n-1}}$; and, since a is very small in respect of r, we shall have for an approximate value, $t = na$: in the above example, $a = \frac{r}{4000\sqrt{10}}$, and if we take $t = r$, we shall have $n = 4000\sqrt{10}$, and the number of atoms in each stratum being $3.1416 \times 640{,}000{,}000$, we shall find, that the atmospherule having a thickness, not more than the radius of the sphere of repulsion, will contain nearly twenty-five millions of millions of ethereal atoms. This supposes that the atoms rest directly on each other; but this will not be the case, since the center of a higher will rest over a point between three or more of the lower, or not so high, as determined by the above rule; hence the above sum will be too small; and if we suppose the atmospherule extended, and the force of the ethereal atoms much less, the number in the atmospherule will be immensely increased, and still more, if we take account of the pressure of the superincumbent atoms.

2. When a ray enters a new medium of the same refractive density, it continues in the same straight line, without sensible diminution of intensity.

3. When the new medium has a different refractive density, and a smooth surface, part of the ray is reflected into the same medium, in a distinct ray; and another part, generally more than half, proceeds as a distinct ray in the new medium, but, if oblique, in a different rectilineal course.

4. Another portion of the light is scattered in radiations from the point of incidence, and a certain portion is absorbed.

5. The angles of incidence and reflection are equal, and in the same plane.

6. The angles of incidence and refraction are in the same plane, and the sines of these angles, for light of a given sort, are in a constant ratio.

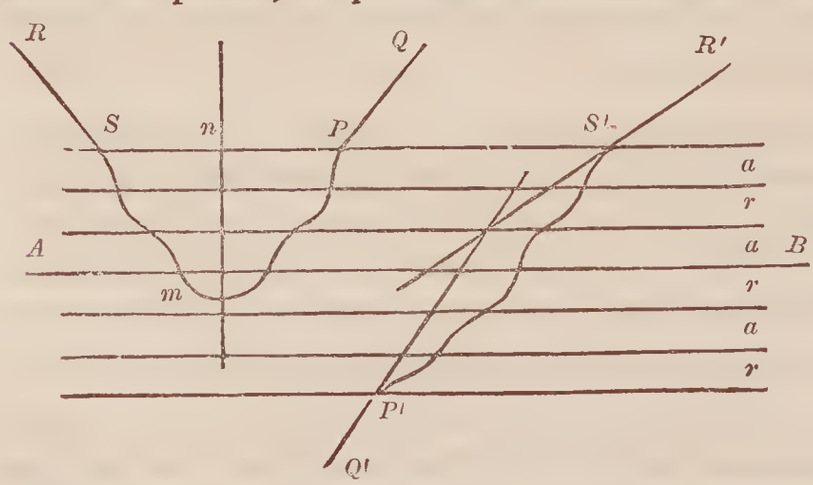
7. Rays of different sorts of light are unequally refracted, the red least, and violet most: and these differences do not observe a given ratio in different media.

8. At angles of greater incidence more light is reflected, and this increase follows a different rate in different media, but generally less than half is reflected.

9. If the new medium is less dense than the other, the light is totally reflected, when the angle of incidence is greater than that which gives the angle of refraction equal to a right angle.

From the postulates required in the Newtonian Theory, art. 5, it follows, that a particle of light is not impeded, or turned from its direct path, while traversing media in which the forces are equal in all directions; and this satisfies the first and second of the preceding facts.

But while it traverses obliquely the confines of two media differing in refractive power, its path will be curvilineal.



Let A B, fig. 1, be the boundary of two media, the spaces between the parallel lines marked *a*, those in which the forces are directed towards the new medium, which may be called attractive; and those marked *r*, opposite or repulsive. It is manifest that the curvilineal course of the ray will be convex towards the axis, as *mn*, in the spaces *a*, and concave in *r*; since by the sixth postulate, art. 5, the resultant of the several forces will be perpendicular to the surface A B. Now if the repulsive forces be sufficient to overcome the perpendicular motion, the ray will be reflected, describing two similar and equal branches of the curve whose axis is *mn*; this satisfies the fifth fact.

But if the repulsive forces are less than this, the ray, as R′ S′, will proceed, in the new medium, in a direction P′Q′, depending on the magnitude of the forces; and, as is completely demonstrated on the principles of dynamics, rays of the same kind will be so deflected that the sines of incidence and refraction will be in a constant ratio. This explains the sixth fact. Hence it follows, that the velocity of light must be greater in more refractive media.

Of the nature of the curves between S and P, and of their lengths, and degree of curvature, we know nothing at all; but the whole of the curved part, as to sense, is a mere physical point, so that S and P apparently coincide, and the force must be incomparably greater than gravity.

The media being given, those particles of light which have a greater momentum, will be less refracted by the given forces, than those which have a less momentum; but that the rays may deviate in different proportions in media of different natures, it is necessary that the attractions and repulsions should be elective; to secure this, Newton required the fifth pos. art. 5, which establishes the seventh fact.

We should expect, that when a ray of a given sort, at a given incidence, is reflected or refracted, at the confines of given media, the whole of it would always be reflected or refracted, which is contrary to the third and fourth facts; hence Newton was obliged to introduce the seventh postulate, which suffices for an imperfect solution of these facts: the eighth and ninth are evident consequences of the preceding conclusions.

13. To shew the enormous forces here required, Sir John Herschel, on data far within the bounds of probability, calculates that the force must be 2×10^{44}, or two hundred septillion times greater than the ordinary intensity of gravity. He adds: "In the undulatory hypothesis, numbers not less immense will occur; nor is there any mode of conceiving the subject, which does not call upon us to admit the exertion of mechanical forces, which may well be termed infinite." See Treatise on Light, art. 561.

It is not easy to form a right conception of the above mentioned number: take grains of sand so fine that one hundred will just lie in an inch, so that one million will fill a cubic inch, how vast the quantity to form a body large as the earth. But two hundred septillions of such fine grains would be sufficient, not to form one, or one million, but three millions of millions of globes, each equal in magnitude to the earth; and as much as the grains in all these bodies is more than one grain, so much is the force required to reflect or refract light, greater than the ordinary force of gravity.

But if the Newtonian theory be admitted, incomprehensibly great as the above estimate is, it falls vastly short of what is necessary for the effect; for in the calculation Sir John Herschel has omitted one essential particular, which is, that the bending of the ray is produced, not by the whole force of either, but by the differences of the forces which affect the particles of the two media: because we know, as a fact, that there is no reflection

or refraction, when the two media are of equal refractive densities; and that these effects are less as the refracting energies of media approach nearer to equality. This bears hard on the Newtonian doctrines; however, the two last articles and the fifth will be sufficient for the reader to form an estimate; we will therefore proceed to explain the same facts, on the hypothesis of undulations.

(To be Continued.)

THE GIANT'S CAVE.

Among the fissures and cavities which we propose from time to time to describe, as occurring in the carboniferous limestone of the West of England and Wales, are a considerable number, to which, from their inaccessibility, or from the circumstance of their being supposed to contain no bones, but little attention has been paid, or indeed supposed to be due.

Independently, however, of the interest which attaches itself to bone caves, or to fissures remarkable for their magnitude, or the splendour of their stalactitical or stalagmitical encrustations, the consideration of rock cavities and clefts seems to promise some valuable points of inference, and may not unreasonably be expected to throw a certain portion of light upon some of the obscure parts of theoretical Geology.

Our readers are probably well aware, that concerning the age and manner of formation of those clefts and cavities, geologists are by no means agreed, and are probably more ignorant upon this than upon any other branch of their science.

The only method by which the elucidation of these subjects can reasonably be expected, must be by a careful examination of a vast number of instances, remarking the figure, dimension, and direction of each, the kind of surface presented by its interior, the nature of its communication with other cavities, its contents, and the condition of the rock in which each may occur. Attention to these circumstances, even if it give rise to no positive results, may yet be expected to disprove several hypotheses upon these subjects; and thus by this negative kind of proof, reduce the real question within narrower limits.

The cave, with a description of which it is our intention to occupy the present paper, is one well known to all the inhabitants of Bristol and its vicinity, although from the difficulty and danger—almost amounting to impracticability—of the access to it, it has hitherto, as far as we are aware, remained undescribed by either geologist or antiquary.

The Giant's Cave, so called from some fabulous tradition, is contained within the upper beds of the carboniferous limestone, these dipping south-east at 23°, and forming St. Vincent's Rock. The cavern opens upon the precipitous escarpment of the rock, at a height of about two hundred and fifty feet above the river, and fifty or sixty below and to the west of the Observatory. A rude and broken ledge extends from the north-eastern

GIANT'S CAVE, CLIFTON.

summit of the rock, downwards, to within about twenty feet of the opening, across which space none but an expert craigsman would venture to pass.

The entrance to the cave is abrupt; it is in the form of a rudely-arched portal, ten feet high by thirteen broad, and perfectly level at the bottom. Upon entering, the breadth remains nearly the same for some distance; but after advancing for nine feet, the roof rises suddenly, and losing its semicircular form, resembles the commencement of a fissure, but stops at a height of eighteen feet. At twenty feet from the entrance, the cave suddenly becomes narrower, and divides into *three* cavities; of these the *longest* and the *lowest*, is the continuation of the line of the great cave; it retains nearly the same width, but the floor descends about four feet, and the roof, gradually curving downwards, terminates the cavity somewhat abruptly, at a distance of forty-nine feet south-east from the great entrance. The *two* other cavities are smaller than the last; they lie, one above the other, on the western side; the *lower* one, about six feet from the ground, and about six feet high, being separated from the *upper* one, which closely resembles it, by a roof of rock. These two cavities opening, the one a little above the floor, and the other almost on a level with the roof, after passing on a few feet backwards, unite to form a passage, which being three feet wide by three high, ascends gently in a straight line twenty-eight feet. This passage is very dark, and its floor, like that of the rest of the cave, is covered with soil, through which the rock now and then appears. Upon its western side, a foot before its sudden termination in a cul de sac, is a small orifice a foot and a half wide by two and a half high, which opens immediately into a small and nearly circular chamber, about three feet high by five feet diameter, and much resembling, both in size, shape, and temperature, an oven. In the north-western side of this chamber, which cannot be above a yard from the exterior of the western face of the rock, are two fissures, one of which is occupied by the root and part of the stem of a large ivy tree; and the other was too small to be entered, but shewed a glimpse of the day-light.

The floor of the cave is strewed with earth and decomposed animal and vegetable matter, in some places to a depth of three feet. Below this, the rock is covered with a layer of stalagmite, masses of which were removed with a pickaxe, but were not found to contain any bones. The walls and roofs are incrusted with a similar deposit, not descending in regular stalactites, but forming, as is frequently the case, an incrustation of about an inch thick.

Upon some parts of the cave, and more especially upon the western wall, is a dark-looking substance, resembling a bituminous exudation; some of this was scraped off, and is now in the museum of the Institution. It appears, upon a closer inspection, to be a species of lichen.

The exterior forty feet of the rock in which the cave is wrought, betrays

at that particular point no very obvious traces of stratification, but towards the interior the dip begins to be apparent. The cave passes across a large spar vein, which lies nearly parallel to similar veins, and to a large dyke of magnesian conglomerate in another part of the rock.

The different faces of this rock, especially near the entrance and southern chamber of the cave, are full of small irregular holes; but the cave itself does not appear directly to communicate with any further range of cavities, although there are many reasons for supposing that such exist at no great distance.

These caverns are usually, throughout the carboniferous limestone, composed of a series of chambers connected by smaller passages. They are sometimes traversed by water, at others dry, or nearly so. The strata in which they occur are sometimes broken, at others not, but are usually so encrusted with stalagmite, as to be invisible or obscure; every now and then a section is afforded by the face of a cliff.*

Besides the ivy and the lichen above mentioned, a considerable number of other plants grow in the interior of the cave. The principal of these are :—

Scolopendrium Ceterach	Cryptogamia Filices.
Sedium Acre .. } ——— Rupestre }	Decandria Pentagynia.
Fragaria sterilis (strawberry).....	Icosandria Polygynia, growing near the cave.
Draba Hirta .. } ——- *Muralis?* }	Tetradynamia Siliculosa.
Scilla Verna Hexandria Monagynia.	Hexan.

The interior of the cave is marked by names, &c. upon its walls, scrawled there probably before the path was rendered, as was supposed, impracticable, in consequence of a boy having met with an accident.†

* Conybeare and Buckland.

† For the lithographed drawing which accompanied this paper, the Journal is indebted to the liberality of Mr. Müller.

A BRIEF ACCOUNT

OF A

JOURNEY ACROSS THE ISLAND OF TAHITI;

Extracted from the rough Notes of a Visitor to that Island in 1826.

Having determined upon visiting a celebrated lake, much spoken of by the natives, and noticed by navigators as one of the most remarkable curiosities of the island of Tahiti, I engaged two intelligent natives as guides, and being properly equipped with apparatus for collecting objects of natural history, thermometer, &c. set off at five o'clock in the morning of December 21, 1826. I proceeded from *Miripeha* to the valley of

Wyereede where we landed, and immediately commenced our journey through a most fertile and magnificent valley, clothed with the luxuriance which tropical countries so peculiarly present. While yet upon the flat, or mouth of the valley, and having determined to make our journey as short and as straight as possible, and being provided with extra shoes, we did not hesitate to pass through shallow pools of water, which would otherwise have taken some distance to have gone round. I here first observed the presence of hot springs, which in several places oozed through the sands, and gave a temperature of 115° of Fahrenheit, when the bulb was thrust into the bubbling sand, while the body of water in the pool was not higher than 76°, the atmosphere being 71°. I may here mention, that it is in this district that fresh water is very conveniently obtained, by taking advantage of a conduit, placed about a quarter of a mile off shore, where the natives have affixed a bamboo in the sand, through the sea water, from which arises a beautiful stream of perfectly fresh water, at which boats can have their casks filled by adding a small portion of hose to the top of the bamboo. Our approach to the house of a friendly chief, named Onai, lay through patches of taro, *arum*, this plant requiring marshy ground for its growth; in these patches are found two species of melania. The vicinity of his house was well marked by the beautiful and ample plantations of native fruits, including many which have been naturalized, such as oranges, custard apples, pine apples, water melons, &c. We were here met by the chief himself, one of the finest specimens of his race, standing at least six feet ten inches high, stout, well-proportioned, and active. Upon reaching his house, I was introduced to his wife, a fine handsome young woman, known all over the island as the *vahina na na*, or "handsome woman," but who at this time had only just been released from the heavy task of making forty fathoms of cloth for the state, which she had been adjudged to do by a jury, for absconding from her husband, and living with a chief belonging to a neighbouring district in Tiarabu. I did not therefore see her with her best looks; for during the performance of this task she had been exposed to the sun's rays, and had become much darker than was natural; but still she well deserved the title of *vahina na na*. In performing these tasks there is no objection to the culprit being assisted; and therefore, in the beating process, she probably had the help of all her female acquaintances, while the young men of the district endeavoured to outvie each other in fetching and stripping the bark, often headed by her husband, who had relented, and sorrowed that he had carried his vindictive feeling so far.

From these people I received great hospitality, and after breakfast the chief accompanied us some distance on our journey; but upon my stating my intention of crossing the island, he smiled at the idea, and prognosticated that I should be knocked up upon or before reaching the lake.

We now began to ascend the country, and, after having penetrated about three miles, I first observed the scarcity of the cocoa nut; and a short

distance further on, of the bread-fruit tree. These were replaced by the fine-spreading chesnut tree, (Inocarpus edulis) called by the natives "mape," from the bark of which a very strong cloth is made, called oa; the miro, a wood not unlike mahogany, much used in boat building, and of which the natives, under the direction of Capt. Henry, built a brig of nearly two hundred tons burthen; the hibiscus; pandanus; not to mention the vi apple, guavas, bananas, plantains, &c. the latter of which, although cultivated extensively in the low grounds, yet are natives of the hills. Upon the leaves of the plantain I obtained quantities of a beautiful reversed snail, the Partula Tahitiana of De Ferrusac, and a species of Succinea. I now noticed with surprise what very excellent naturalists my guides were, their nomenclature being most extensive and certain; it mattered not, however insignificant the plant or insect, I had only to ask its name, when it was immediately given me. Suspecting that Fiope, who was a clever shrewd fellow, did not like to expose his ignorance, I was afraid that he gave me names at random, and very soon put him to the test by asking the guides separately, when I found them to agree in the specific names, although they carried their distinctions of varieties to such a nicety, that several, after a short contest, were left referable to a learned man, whose name I cannot now recollect: in fact, to such minuteness are these distinctions carried, that the natives generally reckon, and distinctly name, above seventy varieties of the cocoa nut tree, (cocos nucifera); above fifty of the bread-fruit tree, of which botanists only name two species, the artocarpus incisa and integrifolia. It is by a careful nurture of the different varieties that they manage to have a constant crop of fruit, each tree often bearing four crops a year. Of the plantain and banana, the musa paradisiaca, and sapientum, they name more than thirty varieties. Independently of this, they have names for all the different stages of growth and approaches to maturity of the fruit.

Our road now lay up a ravine through which a vast body of water was rushing with very great impetuosity; the guides began the ascent leaping from stone to stone like birds, often by their weight dislodging huge blocks of basalt, which continued rolling and carrying before them, with increasing power, all the loose stones in their way. I now found the great difficulty, and at last the utter impossibility of keeping up with the natives, and was obliged to insist upon a more cautious mode of proceeding, which was adopted by taking advantage of the goat paths;* nevertheless we had to cross the stream, wading from knee to chin deep, and the latter so often, that, after counting its repetition upwards of sixty times, I gave up the attempt in despair. I ought to mention that we had had some continuance of wet weather, which unquestionably had swelled the stream very considerably.

* Goat paths exist in great numbers, and the paths they form would generally be mistaken for paths worn by man.

The bed of this ravine, and indeed all the sections which it afforded, consisted of basalt of different degrees of density, containing crystals of olivine and augite; and upon ascending the hills by this route, I discovered no stratified rocks, but disintegrated masses of the before-mentioned minerals and chert. It was during a visit to this and other ravines, that by means of washing the debris through a sieve, I obtained a quantity of the olivine rolled, which found a market in London among jewellers, as a new variety of chrysolite.

Having thus forced our way for certainly not less than ten miles, we came to a cataract, falling from a height of not less than four or five hundred feet, the waters being much increased by the rains. About six hundred feet below the level of the lake, the water passes through the side of the mountain, forming for itself a natural tunnel. The appearance of this and of the fall is exceedingly grand and sublime.

Near two hundred feet above the tunnel I arrived at a chasm, which the guides approached with apparent awe. Upon enquiry, they informed me that this place was frequented by the spirits of departed warriors, there having been a great battle fought on this side of the mountain, after which the dead were buried in the chasm.

We had now ascended above the ravines, and our journey became exceedingly fatiguing, from the very heavy rains which had fallen during the last fortnight, and which still continued without a prospect of their cessation; I was, however, determined to proceed. At one P. M. we had succeeded in ascending this first mountain, whose height, from the level of the ocean, is computed at six or seven thousand feet. We now descended about one hundred feet, when the much-talked-of lake presented itself to our view. Its circumference must be two miles; it has two beaches, the one opposite the other, the sides elsewhere being perpendicular. There is no way of crossing except by means of a raft or by swimming; the natives prefer the latter method, and hence its name *Vaihiria;—vai*, water; and *hiria*, to swim. This lake presents the appearance of a crater, forming a kind of basin, from whence the rain-water can only escape through the natural tunnel before mentioned. My guides now employed themselves in making two rafts of dead banana trees, whilst I shot a brace of fine ducks, and examined the lake for shells, &c. This water appears to contain no animal productions but eels, of which there are some very large and fine ones.

Mr. Henry informed me that he had sounded, and found eighteen and twenty fathoms water. In the centre I could not find bottom with a twenty-fathom line. The surrounding mountains, one of which is the highest in Tahiti *Arafena*, cannot be less than three or four thousand feet above the lake. On the shore I observed several columns of basalt, of seven or eight feet in length, lying on their sides.

At three P. M. the guides informed me that the rafts were ready; the

rain still continued, and at times we were so thickly enveloped in clouds or dense vapour, that we could not proceed. Having arranged my baggage and collection on one raft, I seated myself upon the other, and the two guides commenced swimming, pushing the rafts before them. When about half way across, and while engaged in sounding, the raft upon which my baggage, dry clothes, collection, &c. were placed, unfortunately upset; and the fellow who had the care of the raft on which I was seated, in his hurry to give assistance, left me with such little caution, that I was instantly in the same situation. However, placing my gun and shot belt upon the raft, I made the best of my way ashore, and a more deplorable object could not have been seen: here, very reluctantly, I was obliged to take up my quarters for the night. It being my determination to cross the island to Matavai, we therefore rigged a tent, cooked the ducks, and retired to such rest as the musquitoes would allow us.

By this accident I lost the whole that had been collected during our journey, consisting of numerous botanical specimens, some shells, many minerals, &c. and my instruments. The tent which the guides prepared to secure us from the rain, was erected in an amazingly short time; it was constructed of the gun and three sticks, stuck in the ground under the lee of a rock, the roof being formed of portions of the plantain tree, and covered with the broad leaves of the same: the ducks were cooked in a time nearly as short. The guides took some red bole, which is formed by the decomposition of basalt, and kneading it into a plastic state, cut off the head, legs, and pinion portion of the wings, plastered the whole body over with the clay, and then placed it in the midst of an ember fire: when done, which they by practice seemed to know to a nicety, the ball was soused in water, the clay broken off, and the body of the duck produced, entirely divested of feathers and skin, full of gravy, and highly palatable. My bed was formed of two young succulent plantain trees, cut down and bruised into macheé by large stones. This proved a wet but soft bed; and the principal objection to such a couch was, that when I arose in the morning, it appeared as if I had slept in a tub of indigo, the juice from these plants dying the body of a deep blue colour.

It rained heavily during the night, and I arose at day-break, cold and wet, immediately to recommence our journey, which, for a short distance, led up a ravine, down which rolled a large stream of water to empty itself into the lake. In this stream I found specimens of navicella elliptica, neritina canalis, and auricularia. We now began to ascend an exceedingly steep and high mountain, our lives frequently depending only upon the strength of a few ferns, (the ferns assuming the character of trees often twenty feet high) or what was still more unstable, upon the strength of a plantain tree.

Here at intervals the clouds were dispelled, and the lake then presented itself to the view, together with the distant vallies leading towards the

ocean. At length we attained the summit of the highest mountain but one of Tahiti, the top or ridge of which does not, in some places, exceed three or four feet in width. A few minutes after we had attained the summit, we were obliged to lie down whilst a squall of wind with heavy rain passed over us, during which time we were enveloped by a cloud so opaque and dense, that we could scarcely see each other. The squall having passed, we commenced descending,—to me a far more difficult task than ascending. In our descent I observed several beautiful young *eahi,* or sandal-wood trees. At noon we had reached the plain at the foot of the mountain. The guides now observed a path which appeared to them to have been but lately trod. With great caution they traced it to a native house, which appearances betokened to have but very lately been vacated. This the guide, Fiope, told me was the trace of a wandering tribe of *Tutiouries,** of whom he expressed his fears that they would rob and ill-use us if we fell in with them : we therefore changed our route, and proceeded to a plain at the top of the valley of *Hamaanino.* Our journey now became exceedingly tiresome and dangerous, we having frequently to ford the stream, which, from the great addition to its waters, rolled with it very large blocks of stone, the rumbling of which sounded like distant thunder. In the evening we arrived at a very interesting village, distant, as I afterwards found, nearly twenty miles from the sea-shore. This village or settlement contained about one hundred and fifty people—I think the healthiest and best looking men I have seen upon that island. They behaved with the greatest kindness, killing a hog and preparing an excellent repast, of which I partook, and at their persuasion remained with them during the night. At dusk these natives assembled in a house adjoining, and kept up a *heiva* or dance until midnight, at which they were very importunate that I should be present, which I declined, rather desiring rest, which however was totally prevented by the myriads of musquitoes.

At our parting with these kind people, I was surrounded by a groupe of the elder and influential men, who, in the most energetic manner, entreated me not to mention their existence to the missionaries, informing me that they no longer continued their idolatrous practices, but that they at the same time had separated themselves from their fellow-men upon the shores, rather than subject themselves to the new code of laws, and outwardly follow a persuasion they as yet had felt no conviction in the truth of. It was here that I observed the manners of a people, bearing some resemblance to those described by Wallis, Cook, &c. ; the women wearing high head-dresses, their own luxuriant raven hair plaited and decorated with wreaths of high-scented native living flowers ; their skin much fairer, carrying the bloom of health, and altogether forming a most astonishing contrast with those of the low lands—their clothes were their own manufacture ; the

* Tutiouri signifies rust of iron ; *tuti,* defecated matter; and *ouri,* iron ; which term is applied to persons of a wild or heedless disposition ; Anglice, vagabonds.

men wearing their graceful tibutas, or poncho, as the Peruvian would call it, (a sort of mantle, made of the bark of the bread-fruit tree, dyed yellow with turmeric, and painted by impressing fern leaves dipped in a red vegetable dye, and scented with the essential oil obtained from sandal wood) ; their persons clean and comely, with a bold ingenuous outward bearing, totally unlike the sycophantic, hypocritical, and degenerate race of the shores. To my surprise I did not observe a single case of *fe fe* or *elephantiasis* among these people. In this plain the bamboo and sugar cane grow indigenous, and outvie the cultivated plants in a most remarkable manner ; as also the ricinum palma Christi, or castor-oil plant, the tree which bears the dodoe, or candle nuts, aleurites triloba is here common, and is used by the people of this village to give a light ; they are strung upon the fibre of a palm leaf stuck into stone pots, and lit ; while the people in the lower settlements use cocoa-nut oil.

We proceeded down the valley, and loaded the gun with ball, being informed that wild hogs are not unfrequent. The stream, from the late heavy rains, assuming the appearance of a navigable river for a considerable distance, we had to swim across in many places. At seven A. M. we arrived at a plain, where a large portion of a mountain, about a mile distant, had lately fallen down, and impeding the course of the stream, gave to the upper portion the appearance of being navigable. The guides informed me that it is not uncommon for the sides of vast mountains to open and slide, altering materially the character of the country, and most particularly the line of water courses.

At this place I noticed large blocks of sienite, compounded of decomposed felspar and hornblende. In the bed of the stream below this, were some small portions of a very compact green hornstone, which I was informed was the only stone on the island which would strike fire with steel, and was therefore much valued by the natives ; the other minerals consisted of trachytes, traps, analcime, chabasie, &c. In the stream that we were leaving are immense eels, many of which that had been speared I saw ; they were really formidable creatures, and occasionally inflict with their teeth terrible wounds. With the mass of mineral matter were considerable quantities of semi-fossil coral, precisely similar to the reef now surrounding the island ; this formation I was informed crowned the crest or top of the mountain, part of which I before mentioned as having fallen. On the sides of these hills the pia, or arrow-root plant, grows in abundance.

As we approached the northern side of the island, the stream divided itself into numerous small rivulets, which took their course down the various ravines which terminated the plateau. We now commenced our approach towards the sea, which was made known to us by the presence of the purau and other trees, among which we were again gratified with the presence of the noble ora : many of these trees exceed forty feet in girth, and their bark is beautifully ornamented with parasitical plants. Having

entered the valley of Hamaanino, my attention was now directed to two immense heaps of stones, piled in the form of obtuse pyramids; these were erected over the graves of two Englishmen, mutineers of the Bounty, who were killed in battle, and whose tupapow or ghosts are still supposed to wander about this place, often driving the benighted native, on his return from the mountains with his load of plantains, across a neighbouring mountain, rather than pass the spot. Our eyes had been now directed some time towards a cliff, called by the natives Pihaa. On our approach we found it to present a most magnificent perpendicular mass of basaltic columns, fully two hundred feet high, by three hundred in breadth, the columns irregular pentagons, arranged close to one another without adhering, not vertebrated, nor jointed like the Giant's Causeway, but only occasionally fractured. The columns vary from nine inches and a foot in diameter, to that of two feet; but the most singular part of this formation is, that a great portion of this cliff has the columns gracefully curled into a segment of a circle, as though the whole formation had been in a plastic state, and at that time a movement had taken place which carried or bent the upper parts of these columns out of the perpendicular. At the foot of this cliff meanders the largest of the streams, named the Papé Matavai. To the eastward of this is a cave of considerable extent; I imagine not less than one hundred feet high, with columns overhanging in such a manner as to threaten destruction to any who may take refuge, as we did, from a heavy shower of rain. That masses do fall repeatedly was evident from the fragments strewn over the floor of the cave. The only instance of the jointed columns is on the S. W. side, in the valley of Bunara, where a jointed column stands projected in a cave, and is called the marama ofai, or moon-stone. In the course of our journey we met with repeated specimens of the living soldier crab, pagurus, carrying with it the shell of the turbo setosus, in many instances at an elevation of several hundred feet, and more than ten miles inland.

At eleven, A. M. the ocean opened to our view, and in pushing for the beach, we had to pass through a long grass, called piripiri, which bears a burr covered with prickles of a most annoying kind, penetrating the clothes and scratching the skin, which in tropical climates is readily excited to inflammation. The natives, to avoid this, always on passing through the grass, strip off their clothes, and thus avoid the painful purgatory which the European has to undergo, at whom they always laugh, stating that it justly punishes only the foreigners who first introduced it. It was brought from Norfolk Island by Mr. Crook, one of the first missionaries, and is now so completely spread over the whole groupe of islands as totally to prevent the breeding of sheep, whom it speedily kills by getting into the wool, and worrying them to death by the constant irritation kept up. Having reached the plains at the foot of the mountains, we had only to pass as soon as possible through the various plantations of yams, sweet potatoes, &c. until

we reached the beach about four miles from Hedea. We now pushed for Point Venus, the celebrated point on which Cook established his observatory. On the beach between Hedea and Matavai, the sea had thrown up immense boulders of basalt, many of which weighed several hundred weight, and which, by the constant attrition, were being reduced to pebbles of all sizes, from the finest sand to the size just mentioned. At one o'clock P. M. we rested at Mr. Wilson's house, Matavai.

I should have mentioned that when the sea sets in heavily to Matavai Bay, a bar of sand is thrown up and chokes the mouth of the river; the water is held back until its weight overcomes the bar of sand, and the mouth of the river is again formed.

S. S.

A CATALOGUE

OF THE

MOST INTERESTING VASCULAR PLANTS GROWING WILD IN THE NEIGHBOURHOOD OF BRISTOL.

BY MR. H. O. STEPHENS.

It is only from a conviction that it is the duty of every individual, who possesses the power, to add his portion of information, however small that may be, to the general stock, that the writer has been induced to publish this catalogue. He is aware that it is imperfect, in some genera especially, but it was thought desirable that a catalogue of plants growing in the neighbourhood, should appear in an early number of this Journal; and as no one else came forward in this department, the writer has endeavoured to supply this deficiency to the best of his ability.

A classification of plants according to their geological localities, has been proposed, and would no doubt exhibit some very striking peculiarities, if applied to the botany of a large continent: such a plan is not, however, so applicable to the botany of a single district, in which vegetation is as much affected by change of temperature as by variety of soil. There exists, no doubt, a distinction, and the same plants are not found in the same proportion upon the carboniferous limestone of Clifton and the inferior oolite of Dundry; but this distinction is scarcely sufficiently obvious to obtain in a local catalogue. The Linnean or artificial classification has been followed rather than the Jussieuan or natural one, because, although imperfect, our circumscribed knowledge of the plants o the globe renders the latter no less so, and because it is that generally used in the schools of medicine, and more especially in that of Bristol, for the benefit of which many plants, by no means peculiar to this district, have been introduced.

The writer has to acknowledge the kindness of Mr. G. Rogers, by whom he has been furnished with the habitats of many rare plants, and again to apologise for the incompleteness of some genera, a deficiency which he will

endeavour, in a future number, to supply, as well as to add to the catalogue any other interesting plants which he may find in the neighbourhood.

North Street, *April*, 1835.

Class Monandria, Order Monogynia. Nat. Ord. Haloragiæ.

Hippuris vulgaris. Mare's tail. Banks of the river Frome, about Stapleton. May.

Degynia. Nat. Ord. Callitrichineæ or Haloragiæ.

Callitriche verna. Spring star wort. Ditches about Baptist Mills. April, May.

——— Autumnalis. Autumnal star wort. Ditches and pools, Baptist Mills. September.

Class Diandria, Order Monogynia. Nat. Ord. Oleineæ.

Ligustrum vulgare. Privet. Hedges and Woods, Leigh. July.

Nat. Ord. Onograriæ.

Circæa lutetiana. Enchanter's nightshade. Hedges and marshy banks, about the river Frome. June to August.

Nat. Ord. Scrophularinæ.

Veronica spicata. Spiked speedwell. St. Vincent's Rocks. June.
——— hybrida. Welsh speedwell. ditto July.
——— Beccabunga. Brooklime. Brooks and ditches, common.
——— Anagallis. Water pimpernel. ditto. frequently growing together, formerly in great request in the Spring, when they were eaten as antiscorbutics.
——— officinalis. Common speedwell. Not so common in this neighbourhood, by the sides of the new road under Clifton rocks. May to August.
——— Chamædrys. Germander speedwell. Hedges every where.
——— agrestis. Gardens and dunghills.
——— arvensis. Corn fields and dry places. May and June.
——— hederifolia. Ivy-leaved speedwell. Hedges common. April and May.
——— triphyllos. Three-leaved speedwell. By the sides of footpaths about Stapleton Mill. April, May.
——— montana. Plentiful about Pucklechurch. Mr. Swayne. Leigh Woods.

Nat. Ord. Pistiaceæ, Aroideæ, Hooker.

Lemna trisulca. Ivy-leaved duck meat. Ditches and Pools.
——— minor. Lesser duck meat. Surface of ponds.

Nat. Ord. Labiatæ.

Lycopus Europæus. Gypsey wort, water horehound. Banks of the river Frome. July, September.

Salvia pratensis. Meadow Sage. Wick Cliffs.

——- verbenaca. Wild Clary. Redland, St. Vincent's Rocks. June.

Digynia. Nat. Ord. Gramineæ.

Anthoxanthum odoratum. Sweet vernal grass. Meadows. May, June.

Class Triandria, Order Monogynia. Nat. Ord. Valerianiæ.

* Flowers monogynous.

Valeriana rubra. Red valerian. Walls about the Old Passage. May to August.

* Flowers trigynous.

——— officinalis. Moist hedges and marshes common. June.

* Flowers diæcious and trigynous.

——— dioica. Lesser valerian. Moist fields about Baptist Mills, and meadows about the river Frome. May, June. It must be confessed that this genus sits very awkwardly in the Linnean arrangement.

Fedia olitoria. Corn salad. Corn fields about Stapleton. April, July. This is one of the earliest salads; it is sold in the London markets as early as February.

——— dentata. Toothed lamb's lettuce. By the sides of the towing path by the Avon below Rownham Ferry. June, July.

Nat. Ord. Ensatæ Linn. Irideæ Juss.

Iris pseud-acorus. Yellow flag. Marsh near the Boiling Well, banks of river Frome. July.

—— fœtidissima. Stinking flag. Near Ashley Court, Montpelier. W. G. Rogers. Hedge by the road side, Bishport. June, July.

Nat. Ord. Cyperaceæ.

Cyperus longus. Sweet Galingale. Gathered by the late Dr. Dyer, near Walton in Gordano.

Eleocharis palustris. Spike rush. Ditches about the New Passage. June and July.

Eleogiton fluitans. Floating water rush. Shallow pools about the New Passage. June, July.

Scirpus lacustris. Bull rush. Clear streams, mill dam at Hanham. July, August.

——— Holoschænus. Round-leaved club rush. Ditches near New Passage.

——— maritimus. Ditches about the Severn. August.

——— sylvaticus. Bog near the Boiling Well. June, July.

Digynia. Nat. Ord. Gramineæ.

Phalaris canariensis. Canary grass. In a field near Gallows' Acre Lane, Mr. Rogers. It has no pretensions to be indigenous, and is generally found among the rubbish carried out of gardens.

——— arundinacea, *olim* Arundo colorata. Ribbon grass. Ditches about Redland, &c.

Phleum pratense. Meadow cat's tail. Pastures common. June and July.
Alopecurus pratensis. Meadow fox tail. Meadows. May, June.
——— agrestis. Black bent. A great nuisance to farmers in corn lands. Flowers through the whole summer.
——— bulbosus. St. Philip's Marsh. Dr. Dyer.
——— geniculatus. Floating fox tail. Pools and ditches common. July.
Milium effusum. Millet grass. Woods; Dugard's Wood. May, June.
Agrostis canina. Brown bent grass. Moist ditches by waysides. July.
——— vulgaris. Fine bent. Meadows and Commons. August.
——— alba. Fiorin, or butter grass. Moist fields, ditches about Stockwood, Brislington. July, August.
Aira cespitosa. Turfy hair grass. Clifton Woods. June, July.
Holcus mollis. Soft grass. Clifton Wood, &c.
——— lanatus. Meadow soft grass. Common in fields. July.
——— avenaceus; Smith. Arrhenatherum avenaceum; Lindley.
Avena elatior, Withering. Oat grass. Walls and meadows. June.
Melica uniflora. Melic grass. Clifton and Dugard's Woods. May, June.
Poa fluitans. Sweet grass. Pools about Horfield, &c. common.
—— aquatica. Reed grass. Banks of Avon, Conham; St. Ann's Brook, &c.
—— distans. Reflexed grass. Banks of the Avon, from the dock gates to Cook's Folly, in great abundance. June, July.
—— maritima. Muddy banks of the Avon, under Cook's Folly. July, Oct.
—— procumbens. Under Clifton rocks and waste places about Rownham. July and August.
—— rigida. Hard grass. Walls; on a wall at the top of the hill going from Westbury to Henbury. June.
—— trivialis. Rough meadow grass. } Meadows and borders of fields
—— pratensis. Smooth meadow grass. } common. June and July.
—— annua. A weed every where.
Triodia decumbens. Heath Grass. Clifton Down. June.
Briza. Quaking grass.
Media. Common in Pastures.
Minor. St. Vincent's Rocks. The late Dr. Dyer. May and June.
Festuca ovina. Sheep's fescue grass. Downs, Leigh, &c.
——— duriuscula. Hard fescue. In all good pastures.
——— bromoides. Dry walls.
——— myurus. Wall fescue grass. Walls at Sir. J. Smith's, Ashton, St. Vincent's Rocks, &c.
——— pratensis. Meadow fescue. Meadows, about the Boiling Well, &c.
——— elatior. Tall fescue. Banks of streams and moist meadows; sides of the brook called Hook's Mill Stream. July.
——— loliacia. Spiked fescue. Pastures about Redland, &c. July.
Bromus mollis. Soft brome grass. Pastures every where.
——— erectus. Upright brome grass. St. Vincent's Rocks.

Bromus asper. Wood brome grass. Clifton Wood. July and August.
——— sterilis. Hedges and waste places every where.
——— diandrus. Under St. Vincent's Rocks. June.
——— pinnatus. St. Vincent's Rocks. Dr. Dyer.
Avena fatua. Wild oat. Corn fields, Stapleton.
—— pratensis. Downy oat. Wick Cliffs. July. Mr. Swayne.
—— flavescens. Yellow oat. Meadows plentiful. July.
Dactylis glomerata. Cock's foot grass. Meadows and shady places every where.
Cynosurus cristatus. Crested dog's tail grass. Meadows. July.
Arundo phragmites. Common reed. Ditches about the Avon.
——— colorata. See Phalaris Arundinacea.
Hordeum murinum. Walls and way sides.
——— pratense. Meadows very common.
——— maritimum. Squirrel-tail grass. Banks of Avon under Cook's Folly. June, July.
Lolium perenne. Ray grass. Meadows every where. I have not found Lolium temulentum in this neighbourhood.
Rottbollia incurvata. Sea hard grass. Banks of the Avon under St. Vincent's Rocks. In this grass the florets are so sunk into the rachis, that the plant in flower is rendered very inconspicuous. When the sunshine has expanded the glumes, and the white anthers hang out of them, it is tolerably easy to find. It forms a very considerable portion of the turf in several spots under the rocks. August, September.
Triticum ripens. Couch grass. Fields and Hedges; a too well-known nuisance to farmers and gardeners.

Tetrandria Monogynia. Nat. Ord. Dipsaceæ, Aggregatæ Linn.

Dipsacus fullonum. Teasle. Cultivated for clothiers.
——— sylvestris. Shady lanes about Stockwood.
——— pilosus. Banks of the Frome, in various places. Dr. Dyer's habitat, near Stapleton Bridge, still abounds with this plant. August.
Scabiosa succisa. Devil's bit. Plentifully near the keeper's cottage, Leigh Wood. Mr. G. Rogers. June, August.
——— arvensis } Borders of fields and dry places. St. Vincent's Rocks.
——— columbaria } July to September.

Nat. Ord. Stellatæ Linn. Rubiaceæ Juss.

Sherardia arvensis. Field madder. St. Vincent's Rocks.
Asperula odorata. Woodruff. Plentifully in Leigh Woods. May.
Galium cruciatum. Hedge banks about Horfield, &c. common.
——— saxatile. Clifton and Durdham Downs.
——— Mollugo. Brandon Hill, Clifton Down, &c.
——— tricorne. Corn fields about Stapleton. June, July.
——— verum. Road and field sides every where.

Galium Aparine. Clyder. Hedges.

Rubia peregrina. Madder. Clifton, Leigh Woods, &c. This plant is almost as common in various places in this neighbourhood as Galium aparine. July.

Nat. Ord. Plantagineæ.

Plantago { major, media, lanceolata. Common } Plantain.

——— maritima. Banks of the Avon. Rocks, Weston-Super-Mare. Mr. G. Rogers. June, July.

——— Coronopus. Buck's-horn plantain. Rownham.

Nat. Ord. Berberideæ.

Epimedium alpinum. Barren wort. Leigh Woods, near Leigh. July.

Nat. Ord. Caprifoliaceæ.

Cornus sanguinea. Skewer wood. Leigh Wood and Hedges. June.

Nat. Ord. Urticeæ.

Parietaria officinalis. Wall Pellitory. Old walls common.

Urtica dioica. Rubbish common.

——- urens. ditto.

——- pilulifera. Roman nettle. Under walls at Winterbourne. July and August.

Nat. Ord. Celastrinæ.

Ilex aquifolium. Holly. Hedges about Wraxhall, &c.

Nat. Ord. Fluviales.

Potamogeton natans. Floating pond weed. River Frome, &c.

———-- fluitans. Cut, between St. Philips and the Feeder.

———— rufescens. ditto.

Nat. Ord. Caryophylleæ.

Sagina procumbens. Gravel walks and dry places, Brandon Hill, &c.

——— apetala. ditto ditto.

Pentandria Monogynia. Nat. Ord. Asperifoliæ Linn. Borragineæ Juss.

Myosotis palustris. Forget me not. Ditches, banks of the Frome.

——— sylvatica. Leigh and Clifton Woods.

——— Arvensis. Corn fields common.

——— versicolor. ditto.

Lithospermum officinale. Stone seed. Corn lands, Stapleton. June, July.

Anchusa sempervirens. Alkaret. Redland. Stapleton. June, July.

Cynoglossum officinale. Stapleton quarries. June.

Pulmonaria officinalis. ——— angustifolia. } Spotted and narrow-leaved Lungwort, or Jerusalem cowslip. St. Ann's wood. Mr. G. Rogers. These are very rare plants.

Symphitum officinale. Common Comfrey. Wet hedges.
———— tuberosum. Found in the vicinity of Stapleton. July.
Borago officinalis. Borage. Near Stapleton bridge, about Lamplighter's Hall. Mr. Rogers. Dear to the lovers of liquor; formerly thought to possess the valuable power of raising the spirits, and curing melancholy.

Ego Borago
Semper gaudia ago.

Closely translated by Gerarde,

I Borage
Bring always courage.

See the frontispiece to Burton's Anatomy of Melancholy.
Lycopsis Arvensis. Small Bugloss. Corn fields, Stapleton. July.
Echium vulgare. Viper's Bugloss. ditto ditto.

Nat. Ord. Lysimachiæ Juss. Primulaceæ. Brown.

Primula elatior. Oxlip. About Chew Magna. May.

Nat. Ord. Gentianeæ.

Menyanthes trifoliata. Buck bean. Ponds near the Keeper's Lodge, Leigh Woods. July, August.

Nat. Ord. Primulaceæ.

Lysimachia vulgaris. Yellow Loosestrife. That branch of the river Frome at Baptist Mills, called the Back Ditch. July.
———— nemorum. Leigh and Stapleton Woods common.
———— nummularia. ditto.
Anagallis arvensis. Fields and gardens common.
———— cærulia. Blue Pimpernel. Ashley.

Nat. Ord. Convolvulaceæ.

Convolvulus Soldanella. Sea-bind weed. Sea shore at Weston-Super-Mare. July.

Nat. Ord. Campanulaceæ.

Campanula Trachelium. Nettle-leaved throat wort. Banks of Avon under Leigh Wood. Mr. Rogers. Roadsides about Belmont plentifully. July, Aug.
Jasione montana. Sheep's Scabions. Durdham Down. July, August.

Nat. Ord. Violaceæ.

Viola hirta. Hairy violet. St. Vincent's Rocks.
—— odorata. Blue and white. About Barrow in the greatest profusion.
—— lactea. Cream-coloured violet. Very rare; St. Ann's Wood. Mr. G. Rogers.
—— tricolor. Pansy. Cornfields, Horfield.

Nat. Ord. Solaneæ.

Verbascum Thapsus. Great Mullein. Stapleton Quarries.
———— Blattaria. Moth Mullein. Field near Gallows Acre, probably ejected from a garden. Mr. G. Rogers.

Datura Stramonium. Thorn apple. Rubbish, Newfoundland Lane. Dunghills about Bedminster. Mr. Rogers.

Hyoscyamus niger. Henbane. Steep Holmes. It is not common in the immediate vicinity of Bristol. It seems to affect a sea air, as St. Michael's Mount, Cornwall, abounds with it.

Atropa Belladonna. Deadly nightshade. I have been informed this plant grows in lanes about Weston-Super-Mare.

Nat. Ord. Gentianeæ.

Erythræa Centaurium. Centaury. Clifton rocks and Leigh Woods.

——— littoralis. Pigot's Hill, Weston-Super-Mare. Mr. Rogers.

Nat. Ord. Primulaceæ.

Samolus Valerandi. Water pimpernel. Muddy banks of the Avon under Cook's Folly.

Nat. Ord. Caprifoliaceæ.

Lonicera Caprifolium. Pale honeysuckle. Leigh Woods. Mr. Sheppard. Mr. Rogers, who communicated this habitat, says he has never found it there, nor have I.

——— Periclyminum. Woods and hedges common.

Nat. Ord. Dumosæ Linn. Rhamneæ Juss.

Rhamnus catharticus. Buckthorn. Hedges about Horfield.

——— Frangula. ditto April, May

Nat. Ord. Celastrineæ.

Euonymus Europæus. Spindle tree. Hedges about Horfield.

Nat. Ord. Grossulariæ.

Ribes Grossularia. Gooseberry. Hedges about Belton.

Nat. Ord. Primulaceæ.

Glaux maritima. Salt wort. Lamplighter's Hall, Pill. July.

Nat. Ord. Apocineæ.

Vinca major. Greater Periwinkle. Lane at Sea Mills. Hedges at Stockwood. April.

Digynia. Nat. Ord. Gentianeæ Juss. Rotaceæ Linn.

Gentiana Amarella. Autumnal Gentian. Banks of the Avon, opposite St. Vincent's Rocks, not abundant. August, September.

Nat. Ord. Umbellatæ.

Sison segetum. Corn honewort. Corn fields. Dr. Dyer.

Ænanthe fistulosa. Water dropwort. Stream at Wills' Bridge.

——— crocata. Hemlock dropwort. Ditches about Ashton, Belmont, Frenchay. June, July.

Crithmum maritimum. Samphire. Holmes Islands.

Smyrnium Olusatrum. Alexanders. Formerly in great request as a pot-herb; old *edax rerum* has devoured the reputation of this, as well as of sundry other culinary Umbellatæ, as Chervil, Skirret, &c. It grows upon St. Vincent's Rocks, and abundantly on the Steep Holmes. May, June.

Apium Petroselinum. Culinary parsley. This plant is a native of Sardinia, and has always been excluded from the English Flora; it grows in tolerable plenty on St. Vincent's Rocks, springing from between the fissures of the limestone.

Meum Fæniculum. Fennel. St. Vincent's Rocks.

Pimpinella dioica. St. Vincent's Rocks. Botanist's Guide.

(To be continued.)

QUERIES RESPECTING THE CULTURE OF FERNS.

(To the Editor of the West of England Journal.)

As Horticulture is one among the subjects treated of in the West of England Journal, the writer is desirous of receiving through its pages some information as to the best method of cultivating ferns, which he is persuaded is all that can be wanting to render general their introduction into gardens. The country round Bristol seems to offer peculiar facilities for this, both in the number and variety of this ornamental race which it contains.

He would also be glad of any addition that can be made to the following list of those which are to be found in the district.

Genus.	Species.	Localities, &c.
Polypodium.	Vulgare.	Old trees and walls.
,,	Dryopteris.	Cheddar Cliffs.
Aspidium.	Oreopteris.	Leigh Woods, &c.
,,	Filix mas.	Very common.
,,	Filix femina.	Leigh Woods, &c.
,,	Cristatum.	ditto.
,,	Aculeatum.	Mendip Hills.
,,	Lobatum.	ditto.
,,	Spinulosum ?	ditto.
Scolopendrium.	Vulgare.	Moist banks.
Ceterach (Scolopend.)	Officinarum (Ceterach.)	Old walls.
Blechnum.	Boreale.	Leigh Woods.
Pteris.	Aquilina.	Downs and heaths.
Ophioglossum.	Vulgatum.	Leigh Woods.
Crystea.	Fragilis.	Mendip Hills.
Asplenium.	Trichomanes.	Old walls.
,,	Ruta muraria.	ditto.
,,	Lanceolatum.	ditto.
,,	Adiantum nigrum.	Hedge rows.
,,	Marinum.	Clevedon.

X. Y. Z.

ON LUMINOUS WOOD *

(To the Editor of the West of England Journal.)

In an Essay read at the Bath Literary Institution in the year 1830, I endeavoured to shew that the appearances of fire, or light moving flames, (said to be occasionally seen in marshes, and sometimes also on dry downs;) the objects of superstition, and subjects of poetry, cannot with any probability be referred to any one physical object or class of objects, or cause of luminous appearance. That the names, "Will-o'the-Wisp," "Jack-o'-Lanthorn," "Ignis fatuus," &c. have been given to fire seen at an unknown distance, proceeding from many different causes, from lanthorns of night fishermen or bird catchers, from gypsey fires, from burning weeds, and from peat or lime-kilns.

In Kirby and Spence's Entomology, vol. ii, p. 422, is a clear discrimination between meteoric and electric fires, and another class of luminous appearances, namely, those known to proceed from insects. To the latter, the Ignis fatuus described by Derham, (Philosophical Transactions, 1729,) is correctly attributed; and it is clearly shewn that many similar delusions admit of similar explanation.

There is, yet, one kind of terrestrial phosphorescence, perhaps less commonly seen than the light of the glow-worm, (lampyris nocturna,) yet not uncommon, namely, the luminous appearance of decayed timber, called touch-wood.

Pieces of dry wood, so soft as to crumble when pressed between the finger and thumb, were brought to me from a coppice. They were not uniformly luminous, but each piece, about the size of my hand, exhibited, as nearly as I can remember, at least half a dozen luminous spots, less brilliant than the light of the glow-worm, but rather like the bluish sparks, perhaps of minute Medusæ, not unfrequently visible on oyster shells. From what cause does this phosphorescence proceed? If every rotten stake were phosphorescent; every heap of rotten vegetables, every hop-bed, were luminous; the reply would be, "Putrescent plants always produce phosphorous;" and so inquiry might end. But it is not so. Rotten wood and leaves are not always, but are rarely luminous; and it is this rarity which gives occasion to the following questions.

1. Has the timber of various trees, in a decayed state, been found to exhibit phosphorescence?†

2. Does the phosphorescence proceed from any stage of fermentation?

* This and the preceding paper have come to us anonymously; we shall be obliged to any of our readers who will further elucidate the subjects to which they relate.—Ed.

† A very general belief amongst woodmen and gardeners is, that phosphorescence is peculiar to the decayed ash; a friend assures me that he has seen it in willow wood. My first-mentioned specimens were from an ash tree; I kept them during the day in a dry place: on the following night they had ceased to be phosphorescent.

3. Does it depend on any condition of the surrounding media? on gases? on degrees of heat or cold? moisture or dryness?

4. If only observable in the decayed wood of one or two trees, may not such restriction justify a suspicion that the substance of such trees affords a nidus to peculiar insects, (as scolopendra electrica,) whose ova may possibly be luminous?

5. Has the luminous substance been duly submitted to microscopical, or other, investigation? If it has been so examined, where is the report of such examination to be found?

These hints are thrown out with a hope that they may excite some one, possessing adequate means, to pursue the enquiry.* Perhaps you, or some reader of your Journal, may be prepared to throw further light on this subject, and thus illuminate and gratify

Yours very sincerely,

I. S. D.

* Workmen in peat bogs have told me that they have sometimes seen shining wood, or roots, in the bog; but their description was too vague to afford a guess at the kind of root or wood. This may be the luminous matter to which Thomson alludes, speaking of a "night-bewildered wanderer, who,

> "Perhaps, impatient as he stumbles on,
> Struck from the root of slimy rushes blue,
> The wildfire scatters round, or, gather'd, trails
> A length of flame deceitful o'er the moss."

Such a phænomenon, in such a situation, might indeed result from trampling upon putrid fish.

ON THE RELATIONS BETWEEN MIND AND MUSCLE;

(Being the substance of a Paper read before the Philosophical and Literary Society of Bristol, Dec. 1834.*)*

BY J. A. SYMONDS, M. D.

PART II.

1. The first groupe of involuntary motions, is constituted by those which are immediately consequent upon certain organic conditions, without sensation. It includes all the muscular actions which belong to the mere nutritive life of the system,* and which result from a property in the organization of the part, called irritability, and the application of a stimulus. Such is the contraction of the heart, excited by the stimulus of blood, such also the vermicular motion of the stomach and intestines. The action of the respiratory muscles belongs to this head, though there has been some controversy on the subject. Some physiologists are of opinion that the

* These have been generally, but very erroneously, made to *monopolize* the term involuntary.

movements in the function alluded to are occasioned by a sensation of distress, and a consequent desire of relief produced by the venous blood in the lungs; but there is no evidence from consciousness that in ordinary respiration any such sensation does actually take place. It is true that when an obstacle is presented to the aeration of the blood, we for the most part experience uneasy feelings, which are followed by voluntary exertions of the accessory muscles of respiration; but in that kind of respiration which is commonly going on, and frequently when consciousness is altogether suspended, or occupied with other subjects, all that we know of the causation of the muscular action, amounts to nothing more than that black blood reaches the lungs, and that the diaphragm descends; and we have as much reason to say that the former event is the stimulus of the latter, as that blood is the stimulus to the contraction of the heart; the only difference being, that the influence of the black blood in the lungs upon the movements of the diaphragm, is probably transmitted by nerves.

2. We pass on to the second head,* which comprehends many interesting actions, and among them certain kinds of respiration, which are frequently characterized as voluntary, though possessing no title to that designation. Respiration does not become voluntary till a feeling of desire has arisen for increasing the action, or for overcoming an impediment to its exercise; but on many occasions, uneasy sensations in the chest occur, and are followed by an increase of respiratory movement, without any mental feeling amounting to will or desire; as for instance, in those occasional muscular contractions which constitute sneezing, sighing, coughing, laughing, yawning, &c. and which all belong to the class respiratory. A tickling sensation in the nose causes sneezing; a sensation of weight about the lower part of the chest, sighing; an irritation in the windpipe, coughing; and in each case the action instead of being prompted by the will or desire, takes place in direct opposition to it. We shall content ourselves with merely hinting at these instances, in order that we may have more time for considering certain other interesting movements which belong to the present head; those, namely, which are employed in preserving the balance of the body.

Every one by experience knows both the feeling of equilibrium, and the fear of losing it. Yet there is nothing more worthy of admiration in the whole animal economy, than the fact, that without any knowledge of the centre of gravity, or of its situation in the body, or of the law by virtue of which a body must fall, if a perpendicular from the centre of gravity passes outside of the base of support, a person shall notwithstanding experience a sensation which gives him an apprehension of falling, whenever the centre of gravity is lost; but when we consider that this sensation is immediately followed by instinctive motions, which tend to recover the

* Motions consequent upon internal sensations.

lost centre, our admiration must rise still higher. But although the process of equilibration is essentially instinctive or involuntary, it may be much assisted by voluntary exertions and practice. No instinctive feeling or motion could keep a person balanced on a tight rope, on the first occasion of trying that position. The constant use of this feeling in some of our ordinary movements is very striking. Let us take that of walking, for instance, and endeavour to analyse it. The very first action is a shifting of the centre of gravity, which would otherwise be lost in the subsequent movements. To prevent such an occurrence, the weight of the head and trunk is thrown upon one inferior extremity, instead of being shared between the two. After this has been accomplished, the other leg is bent, raised, projected, and replaced on the ground: when replaced it is in a state of extension. The next movement is to throw the centre of gravity into a perpendicular between the legs, by rotating the posterior leg on the foot, and bending the anterior knee. The weight is then shifted to the anterior limb, by raising the heel of the hinder foot, (which acts as a lever of the second order) the leg being kept in a state of extension by the same action, so as to form a sort of inflexible rod for pushing the pelvis forwards. Lastly, the hinder leg is bent, raised, and brought up to the other. This is the analysis of a single step, the constituent movements of which require comparatively little nicety of equilibration; but in walking, the weight of the body is not only transferred from one limb to the other without any intermediate rest, but while poised on the one, suffers a motion of rotation on the head of the thigh bone, of much greater extent than in the former instance, because the hinder limb is not replaced upon the ground when it has come into a line with the other, but is kept suspended and projected. During the latter process, the weight of the limb and the action of the muscles which throw the body forward, tend to disturb the equilibrium; the weight tending to one side and the propulsive force to the other.

The walk of aged and feeble persons consists of a succession of steps, because in these movements there is less muscular power required, both in balancing the body and in projecting the limbs. A person who either from weakness or from intoxication does not enjoy a full command of his muscles, or in other words, whose muscles do not act in harmony with the feelings peculiar to equilibrium, has a rolling gait, occasioned by one leg passing in front of the other. This action results from a want of the natural adjustment between the propulsion, the rotation, and the tranference of the weight.

Giddiness is the loss of the feeling of support; but what is the cause of the natural feeling of support, or equilibrium? On first putting this question, it might seem to be answered by saying, that the feeling in question is only that of pressure in a particular part of the body. The whole weight of the system resting on so small a surface as the sole of the foot, must occasion considerable pressure; and although we have ordinarily no con-

sciousness of it, yet the removal of that pressure, as in the case of falling, may produce a sensation, on the same principle as that which often causes us to feel the absence, but not the presence of a stimulus. This expression, however, is not very logical; it only means that the nerves of a part having been long accustomed to the presence of a certain object, cease to communicate any impression in connection with that object, but that the removal of the object occasions a new condition of the nerves which is instantly recognized. This fact has been experienced by every one on leaving off a ring, or any article of dress that made some degree of pressure; the loss of it is immediately discovered, though its presence had been forgotten. Is it a similar feeling which constitutes the sensation of falling, that is, loss of support? We can scarcely account for it in this manner, because the feeling is not referred to the part which had previously been suffering the weight; on the contrary, it is diffused and only like itself. The question then recurs, how is the feeling caused? We cannot doubt that although it cannot be identified with the sensation of pressure just alluded to, it bears a very intimate relation with the state of the nerves in the parts which sustained the pressure. When the body is supported, there must be compression in some part or other, greater or less according to the extent of the supporting surface; when not supported (as when we lose the centre of gravity) there is no such compression. Now although neither the existence nor the absence of this compression may be attended with any *local* sensation, it is easy to conceive that those parts of the brain,* which are the seats of the feeling and determine the motions of equilibration, may entertain such a relation with the distant nervous extremities, as immediately to undergo a change when the compression of the remote organ is removed, and in that change to produce the feeling which we designate loss of balance, and to excite the corresponding actions.

Derangement of the feeling of equilibrium may have causes either external or internal. To exemplify the former:—a person standing on a high ladder, or on a plank stretched over a chasm, may easily lose his feeling of equilibrium, notwithstanding the same degree of pressure is made, as is usual in the upright posture. He is disturbed by his vision, which can perceive no support but the surrounding air; he imagines that he is falling, and instinctively throws himself into an attitude which was intended to preserve the centre of gravity, but which in reality overthrows it, and thus he falls in reality. *Internal* causes are more common;—e. g. some disturbance of the nervous system produces in the individual a false kind of vision; objects appear to move, and the ground on which he stands, seems to rise or to fall from under him. He in this case, as in the former, assumes an attitude adapted to his false conception of his relation to the ground on which he stands, and suffers a similar consequence.

* The existence of such parts has been proved by modern vivisectors of animals.

Or his nervous derangement may be of a different kind. He may experience the sensation of being himself tossed up and down, or whirled round and round, when his support is in reality most secure, and his muscles are in a state of inaction, as for instance, in the recumbent posture. Many persons have known this feeling after inhaling tobacco for the first time; and it is said to occur to the drunkard, either when staggering and reeling, or when prostrate on the ground.

It would seem that in some cases of vertigo, the *feeling* of giddiness is not a perverted one, but that the disorder of the nervous system relaxes the muscles which usually preserve the erect posture; and that upon this relaxation the body is in peril of falling, and is felt to be so. In this instance the sensation is a true one, that is, indicates the actual condition of the body. The individual thus affected, catches at some support with his upper extremities, which perform the duty of the lower ones.

In the lower animals the motions of equilibration are sooner developed than in ourselves. The kid follows its mother on the mountain side on the very day of its birth; and the chicken walks as soon as it has left the shell; but the child suffers many disappointments before the feeling in question is followed by its appropriate motions.

It would be interesting to enter into further details upon this subject, but enough has, we hope, been said to shew that desire or volition has no necessary connection with the actions that belong to equilibrium.

3. The next class of instinctive motions are those immediately consequent upon external sensations.—A remarkable instance is the suction of the infant. The simple sensation produced in the lips induces those beautifully connected actions of the muscles of the tongue, mouth, and pharynx, which extract the nutritive fluid. Sometimes the mere tactual impression is sufficient; at others it is necessary that the taste should be excited. No one can for a moment suppose that the infant exerts any volition or feels a desire for the muscular movement in question. If from any circumstance the fluid excite disagreeable sensations, his muscles do not act. When he has become familiar with the gratification, he appears to have the power of increasing the actions; i. e. he remembers the motions which have formerly produced enjoyment, and desires their repetition to a degree which wonderfully increases their energy. He also becomes able to suspend them either from mere caprice, or from other motives, even when the sensation which was wont to provoke the action, is scarcely less agreeable than formerly. In animals this kind of instinctive movement consequent on sensation is very remarkable. The lamb just born follows its mother by sight; the blind puppy by scent; and the newly-hatched chicken pecks at grain. Another example of the class before us is the motion which follows an impression of pain. Place a hot body on the hand of a person in deep thought, and the latter is retracted immediately. If a person walking rapidly round a corner, happens to come suddenly upon the margin

of a pit, the sight produces instantaneously a movement, the very opposite to progression. In this case the vision and motion are *all but simultaneous,* and certainly have no intervening desire or volition. Some motions belonging to this class take place in opposition to desire. Winking the eyes is a motion which follows the sight of any thing which threatens the organ with injury. It is a common trick among school boys to attempt to restrain the action, when a body is made to appear to approach the organ; but it is only after repeated trials that the attempt succeeds.

4. The fourth class comprehends those movements which are prompted by emotions. From this category we must by necessity exclude such movements as are the *objects* of desire, though the exception does not extend to those which merely follow the desire of *other* objects. Some of the most common instances of the division under consideration, are the muscular movements expressive of the passions. The greater number of these occur in the face, and their character is familiar to every one. Whether the recognition of the presence of a passion in another person be the effect of instinct or of association, would perhaps admit of some question; but no one doubts of the fact. Joy, sorrow, anger, complacency, fear, courage, confidence, distrust, all have their lineaments in the quick darting motions of the eye, the varied surface of the cheek, the expansile nostril, the pliant lip, and the smooth or wrinkled forehead. All the changes in expression occur merely because certain emotions have occurred, and there is no intermediate mental event. A struggle for predominant expression often takes place among the emotions, when several are present or occurring in quick succession; but the strongest is cæteris paribus, that which is obeyed by the muscles. No emotion is oftener contradictory of the others than desire. A man conscious of a particular passion, and that it may be betrayed by his face, desires to restrain the manifestation. His success will depend on the degree of the first emotion, or on the frequency with which his facial muscles have assumed an arrangement indicative of the state of mind which he wishes to simulate. Gestures are of a nature precisely analogous to physiognomical expression.

Under the present head we may also arrange those vocal movements which communicate particular feelings, and are common to all ages of the human being, and to all animals possessed of vocal organs. The shriek of terror, the scream of pain, the sigh of grief, the yell of resentment, the exclamations of joy and delight, are as every body knows involuntary,—nay, sometimes *anti*-voluntary. But they may all own desire for their cause, like gesticulations and changes of countenance, when we are anxious to feign the passions which they indicate. The emotions which approach more to intellectual conditions are also related with muscular actions altogether involuntary. The perception of the beautiful, the sublime, the wonderful, and the ludicrous, are all attended with appropriate demonstrations, and none more decidedly than the last.

The groupe under discussion includes certain actions of the muscles of respiration, which have not received that degree of attention which they deserve. Every one must have noticed the alterations of breathing under the influence of emotion. It becomes quicker or slower, or is interrupted, merely as it would appear in consequence of the excitement of the nervous system; but the final cause of the derangement is by no means evident. When two or more persons are engaged in some action which requires stealth and silence, it is common for them to remind one another to hold the breath, lest it should be audible. But why should this injunction be necessary? Under ordinary circumstances, respiration occurs as noiselessly to others as unconsciously to the subject. No other probable solution of the question occurs to me than the following. On occasions of the nature alluded to, the solicitude or mental attention produces an unusual excitement of the nervous system, and a consequent hurry of the breathing, which becomes audible; and it is to restrain this derangement of an ordinarily quiet action, that the voluntary effort is enjoined. Something also may be due to the prolonged intervals between inspiration and expiration, demanded by those movements in which particular care and nicety are requisite. In such cases the chest must, for longer intervals than ordinary, present a steady immoveable fulcrum to various muscles, a condition which can only be effected by the closure of the windpipe, and by the consequent prevention of the ingress or egress of air. The mere attention of the mind to a sensation, that of hearing, for instance, will likewise cause an irregularity of respiration; a fact familiar to every one who has listened with anxiety to a faint sound, the step of an expected friend, a distant echo, an important whisper, &c. Mere intellectual excitement will produce the same effect. Who has not remarked the hurried or suspended breath of an audience, under the influence of a powerful harangue?

5. The fifth section embraces those movements which pertain to imitation. Imitation may be active or passive, i. e. prompted by desire or independent of it. The latter only concerns our present subject. One person yawns, or sighs, or laughs, because another does; a fact utterly inexplicable in the present state of our knowledge.* Any set of muscles may acquire particular actions and assemblages of actions, by passive imitation only; and to such a degree, indeed, that desire is often vainly employed in opposition to this principle. A child or susceptible female, if frequently in company with a person who winks, or stammers, or faulters in his gait, will fall into similar habits, notwithstanding there may be a variety of inducements for attempting to avoid them. The following passage from Coleridge's "Christabelle" is a well-drawn picture of involuntary imitation:—

* Some fancy that they can explain the fact by referring it to sympathy. But this is only comparing it to something equally unintelligible, which occurs in the system of a single individual.

"The maid, alas! her thoughts are gone,
She nothing sees—no sight but one!
The maid, devoid of guilt and sin,
I know not how in fearful wise
So deeply had she drunken in
That look, those shrunken serpent eyes,
That all her features were resigned
To this sole image in her mind;
And *passively did imitate*
That look of dull and treacherous hate,
And thus she stood in dizzy trance,
Still picturing that look askance,
With forced unconscious sympathy,
Full before her father's view."

In a similar manner persons contract the pronunciation of others; a fact that will account for national peculiarities of accent. The laugh of a crowd, nay, its gestures and acclamations are often quite as much the result of this principle of imitation, as of similarity of feeling derived from a common source. But the most remarkable instance of involuntary imitative motions are observed in various disorders of the nervous system. The contagiousness of hysterical exclamations and convulsions is known to every one. Physicians are not unfamiliar with the communication of other disorders of motion of a more serious nature; such are the imitative forms of epilepsy and chorea; to the latter of which we shall recur directly. Such affections are not only without desire, but contrary to it. The influence of the principle under consideration is of the last importance, not only in a physical, but also in a political and moral point of view. It has too often happened that the most atrocious crimes have been repeated by persons, who are not only free from the operation of motives similar to those which instigated the first perpetrators, but whose minds may loathe the very contemplation of such actions, at the very time that the morbid impulse is hurrying them on. It has long been matter of observation that one suicide creates many. A remarkable fact of this kind is related by M. Andral. "A few years since, at the Hotel des Invalides, a veteran hung himself on the threshold of one of the doors of a corridor. No suicide had occurred in the establishment for two years previously; but in the succeeding fortnight, five invalids hung themselves on the same cross-bar, and the governor was obliged to shut up the passage. During the last days of the empire, again, an individual ascended the column in the Place Vendôme, and threw himself down and was dashed to pieces. The event caused a great sensation; and in the course of the ensuing week, four persons imitated the example, and the police were obliged to proscribe the entrance to the column." Would that the influence of a morbid imitation were confined even to self-murder! Such, however, is far from being the case. The study of that most awful of all kinds of mental alienation, the homicidal monomania or murder madness, reveals but too many facts confirmatory

of the principle, that persons, altogether uninfluenced by any ulterior object, may perpetrate actions most revolting to the moral nature of man in its healthy condition; and that the only discoverable reason is, that such persons have witnessed or heard of the commission of similar atrocities by others! So convinced are we of the injurious influence which the narration of crimes exerts upon individuals of a susceptible temperament, that we should rejoice to see some kind of restraint laid upon that extreme licence with which the details of crimes are constantly obtruded on the public eye.

It is impossible to find more striking instances of the influence of imitation or sympathy than in the records of certain epidemic nervous disorders. Dr. Hecker of Berlin, the author of the History of the Black Plague, has written a most curious narrative of the epidemic dance of the middle ages, a French translation of which we have perused in the last number of the "Annales d'Hygiène."* Dr. Hecker relates that soon after the cessation of the black plague, in the fourteenth century, bands of men and women, afflicted with the derangement in question, used to wander from village to village, and even through towns, presenting to the inhabitants a most strange and distressing spectacle. They were wont to form in circles, and then to dance with the greatest violence and transport, whirling themselves round and round, utterly unconscious of every thing about them, till they fell exhausted to the ground. They suffered spasms and convulsions of the most torturing description till the paroxysm abated. During the dance, they often beheld apparitions; some were blessed with visions of angels, and with glimpses of heaven, while others could perceive only dæmons and flashes from the infernal regions. Wherever these unhappy individuals arrived, numbers of the inhabitants became similarly affected. To prove that this communication of the malady was the effect of imitation or sympathy, Dr. Hecker states that the sight of certain wretches, who, for the sake of gain, affected these antics, produced the same results as in the true cases. These dances were honoured with the names of St. John and of St. Guy; of the former, because they commenced at certain religious ceremonies sacred to that apostle, (which, however, resembled Bacchanalian orgies, rather than Christian rites); of the latter, because many sufferers had been cured in the chapels of St. Guy, whom they were therefore bound in gratitude to consider their patron saint. The epidemic was not extinguished for nearly two centuries. One not unlike it prevailed in Italy, under the name of Tarantulism. The persons affected fancied themselves bitten by a particular kind of lizard, and became melancholy and stupid, till aroused by the music of the flute or guitar; they would then become animated, and commence dancing in a most extravagant manner, never giving over till overpowered by extreme fatigue. Sometimes the patients

* Since the above was written, an English translation of this history, by Dr. Babington, has been announced.

had a vehement desire for the sea, and flung themselves into it. The disorder disappeared in its epidemic form, in the eighteenth century. Hecker alludes to a similar affection which prevailed in Abyssinia, under the name of Tigretier, and which has been described by our countryman, Pearce. It had the same dancing character, and was soothed by music. The irresistible tendency to imitation was strongly marked in the case of a woman, (related by Tissot) who never could avoid doing anything which she saw others do, and was consequently obliged to be blindfolded when she walked the streets. To the operation of the same principle, Dr. Hecker attributes certain fanatical exhibitions among the Jumpers in our own country, whose fame, it appears, has extended to Germany. Locality is often deeply concerned in the production of similar incidents. Thus we are told by a French author, that a supposed miracle having been performed before the convent of St. Genevieve, such a number of similar occurrences happened on the same spot in a few days, that the police were compelled to post a peremptory notice on the gate, " prohibiting any individuals from working miracles in the place in question."

The limits prescribed to this essay, oblige me to abstain from further remarks upon this subject, else it would be interesting to trace the imitative instinct in certain of the lower animals, to shew its subservience to various important purposes in our own species, such as its vast relations with the moral and social condition of man, its connection also with the facts that belong to animal magnetism, and with various kinds of mental aberration.

(6.) The last groupe of involuntary actions are those of habit; a term inclusive of a variety of most interesting motions, which although originally produced by desire, have acquired an instinctive character. It is a law, no less constant in the intellectual and moral, than in the corporeal œconomy of man, that actions which have frequently co-existed, or followed each other in a certain succession, have a tendency to repeat that association or sequence, even when the causes which originally produced them are no longer acting. Thus, let A, B, and C, represent so many muscular motions which have followed each other, but which have each been effected by desire. After a repetition of their occurrence a certain number of times in the same order, they will stand in the relation of causes and effects to each other. It will no longer be necessary that an act of volition should transpire between A and B, or between B and C; but the mere occurrence of A, will be enough to produce B, and B will have the same effect on C. In our walking and active moments we can scarcely exist without affording an illustration of this law. To walk, to run, to assume any ordinary attitude, to perform any common manipulation, to speak, to write, is to present an exemplification of the same principle. To all the elementary motions of which these actions are composed, desire or volition was originally, perhaps, a necessary antecedent, but is such no longer. Let us take

the instance of walking. A person wishes to fetch a book at the other end of a room, and walks in search of it: in this performance, does he will the several motions in which walking consists? If he has been enfeebled by disease, the muscular actions may require the stimulus of desire, but in ordinary health and strength he goes through the evolutions unconsciously. How is it then that these voluntary actions take place without any volition at all? The explanation is a very simple one, and we cannot help wondering that some very able thinkers have thought it necessary to conjecture that in such a case the individual must in reality have willed each separate movement, but that the acts of consciousness were so brief and transient that he had forgotten them. The true theory appears to our apprehension involved in the fact, that the motions in question have so often followed each other, that the mere wish to perform the particular action which they compose is enough to prompt the whole series. But it is not necessary that the person should even thus far will the motion. It is enough that he wishes a certain change of place, and the action which has so often followed this wish, occurs without the additional impulse of any other desire or act of volition separately devoted to it. Moreover, he may walk in a certain direction, without any desire at all. He may set out towards some point, his will having merely directed the initiative movement. In the course of the walk, his mind becomes occupied by various thoughts, and the intention of his journey not being constantly present, he is liable to be carried in a direction very different from that which he had designed. He arrives, perhaps, at a turn in the way, which he has been accustomed to pursue, and is taken along it unconsciously, far out of his original plan. He may even find himself knocking at the door of a deceased friend, or of one whose acquaintance he had dropped. In the latter case, the sight of the road, or of the house which was wont to determine his desire for moving towards it, has been sufficient to produce the movement, (without any intermediate desire) by the mere force of habit; which will continue to operate, till he is reminded of his intention of proceeding in a different direction.

Let us try another instance, that of speaking. The articulation of every word was once, perhaps, the result of effort; a voluntary exertion of the vocal organ to imitate a sound produced by another. But now it is enough for the word to occur to the mind, and the pronunciation follows, without any intermediate volition, merely because the idea and the action have been accustomed to the relation of antecedence and consequence. Again: I may use some word which I not only did not intend, but which I would much rather have avoided, as it may be personally offensive to the person with whom I am conversing. This word, in all probability, will be found to be similar in sound to that which was present to my mind, but which was not expressed by my voice. The word was the product of a certain aggregation or series of vocal movements, which followed some initial

movement common to it, and to that other series which properly belonged to the idea in the mind. This we conceive to be the meaning of what is commonly called a *lapsus linguæ*, and is very different from a malapropism: *the latter is a mistake of the mind, the former is a mistake of the muscles.* A similar error not unfrequently occurs in writing. A perfect master of orthography may commit a mistake of this kind; he may write, for instance, the adverb *there*, though the pronoun was in his mind, merely from an irregularity of muscular succession. The tracing of a word on paper is the result of a particular set of muscular movements; but words of very different meanings may have very similar sets, and even initially identical, as in the instance just mentioned; and hence the mistake arises. We have heard persons say that a bad pen would make them mis-spell; in such a case, the impediment offered by the pen causes an irregularity in the succession of the movements. But it may be asked, how is it that we sometimes utter or write a word no less dissimilar in sound and in symbolical characters, than foreign from the subject discoursed of? The causation in this case is different; the error exists in the mind, and arises from our being occupied with more than one series of ideas; in which case an accidental exchange takes place between the series communicated, and that which is retained. To a person engaged in writing, when others are talking around him, the accident is very liable to happen. Some word makes a particular impression on his mind, and diverts him a moment from his previous train of thought; but his muscles continue to act, and follow the impulse of the word in question, as of any other that passes through his mind, more germane to the matter in hand. From what has been said, then, it is deducible, that there are motions immediately consequent on ideas, in the same manner as others are consequent on sensations and emotions; but we have not arranged the former in a separate class, because we are not aware of any evidence that *ideas* assume the relation of proximate causes to *motions*, except under the operation of the general law or principle which we have been engaged in illustrating; while sensations and emotions, on the contrary, manifestly produce their appropriate actions, without any reference whatever either to association or succession.*

* The beneficial influence of this law of muscular action will be obvious, on considering the inconvenience that would arise, were it necessary that the mind should be constantly directed to our ordinary actions. Authorship would be as rare as now it is frequent, were a writer's thoughts to be distracted by attention to his manual employment. How many sublime meditations would have been lost to the world, if the legs of peripatetic philosophers had required the constant superintendance of their minds. Or to come down to more ordinary pursuits; the knitting needles of the intelligent lady would make but slow progress in their charitable employment, were her muscles unable to guide them without the direction of the mind, which is engaged in the conversation of her friends. How could the weaver sing his psalms, or the waggoner whistle his rustic strains, did the shuttle of the one, or the whip of the other, require that mental attention which is occupied by their respective melodies?—Hundreds of such instances will occur to every one.

From the consideration of habit in connection with muscular motion, we cannot resist the temptation of an easy transition, to offer one or two remarks upon talent. When a person is observed to be particularly skilful in any art or operation, it is common enough to allege two different causes for his dexterity. In the opinion of one speculator it is due to practice or habit; of another, to original power or capability. In some few cases, only one of these opinions may be right; in the majority they will both be correct. Habit, we have said, is the tendency of certain actions to co-exist or to succeed each other, for no other reason than that they have formerly been co-existent or successive; hence the facility of an often practised movement. Talent is a peculiar constitution of an individual, by virtue of which, a succession of actions which in other persons must have very frequently succeeded each other, in order to be performed readily, do in that individual occur easily at the first effort, or after a very few efforts. A difficult operation is one that with most persons requires a number of oft-repeated desires, or volitions, or attempts (attempts being actions begun and not ended) but which may become perfectly easy afterwards. Yet this operation may to one individual be easy at the first inclination of his mind to perform it, whence he is said to have a gift, a talent, a genius for it. If the action partake of the sublime or beautiful, as in the execution of a fine painting or sculpture, he may even be said to be inspired. But whatever name or expression be annexed to the facility in question, it implies that very little desire or effort is necessary, and that the actions produced by it approach very closely to the instinctive. To instance a talent for drawing. One boy shall upon the first attempt to copy any object on paper, produce a far more correct representation than one who has made twenty attempts. For producing a successful copy two things are necessary—a correct remembrance of form, (for it is impossible to look at that which is to be copied, at the time of using the muscular action which directs the lines) and the occurrence of such muscular movements as direct the pencil along an imaginary line on the paper, corresponding to the one remembered. The figure, or a part of it, must be imagined on the paper and traced by the hand. A talent, then, for drawing, signifies a correct memory of figure, and a facility in executing the requisite movements. The former may be present, but without the latter will never ensure success to the efforts; nor the latter without the former. The separateness of these facilities may often be noticed in children when learning to write, which is obviously a kind of drawing. One will be able to trace in ink, with great neatness and regularity, characters which have been marked in pencil; thus shewing that there is no defect in the muscular actions; and yet shall be incapable of tracing them without this assistance. Another, again, may have a sufficiently definite conception of the form, and yet fail in the delineation, from want of muscular readiness. Each, however, after many unsuccessful efforts, will attain his object, and even perform the operation with ease, by help of that principle, the dis-

cussion of which has led us into observations far more lengthened than we originally contemplated.

A retrospect of the several classes of motions which have passed under our survey, will convince us, that to say the least, a very large share of the movements commonly considered to be the immediate and exclusive products of volition, may and do most frequently originate in other states of mind. Perhaps the following attempt at a classification, if useful in no other respect, may serve the purpose of recapitulation.

1. *Involuntary Motions.* Synonymes—*Organic, Automatic, Instinctive.* Character—In ordinary circumstances, unoriginated, and uncontrouled by desire, and often opposed to it.

2. *Voluntary Motions.* Synonymes—*Animal, Relative.* Character—Controulable by and coincident with desire, but not indebted to it for their origin.

3. *Volitional Motions.* Character—Originated by desires, of which they are the sole objects.

We are fully aware that this arrangement is liable to the objection, that the same specimens of muscular actions might at different times be placed in different classes. Thus coughing, when induced by a physical necessity, and contrary to the inclination, would belong to the first; when occurring physically, and capable of being checked, but allowed to continue, because known to relieve the chest, would be ranked in the second; when produced for the sake of mimicry or affectation, its place would be in the third. Difficulties of this kind attend classifications in every science; but if they afford us any assistance in distinguishing phænomena, their end is answered.

To some of our readers it may at first sight appear, that we have been busied in a mere controversy of words; but a further consideration will, it is hoped, convince them that actual differences of *ideas* have been involved in the discussion. But if any should urge that it is useless, or laborious trifling, to spend so much time in distinguishing such faint shades of thought, in untangling such gossamer webs, they might be asked (without dwelling upon the advantage of keeping in readiness and keenness, by constant exercise, that faculty of analysis, which is the chief and essential instrument of all true logic,) whether such topics as have engaged us, may not be at least as fit objects of consideration, as whether there be a resisting medium in the universe or not, whether light be a radiation or an undulation, whether the central vessels of a plant carry sap or air, &c. &c. questions which are justly esteemed very worthy of the attention of philosophers, not because they are applicable to any practical purpose, but because they are questions of truth. All branches of knowledge are liable to such objections as we have alluded to. And if it be asked, why say so much about things so well known and familiar as desire, and will, and motion? we content ourselves with replying, that a similar question might be put to the geologist, what possible good is there in looking

so earnestly at a bed of gravel?—or to the botanist, why spend so much time over a handful of common weeds?—or to the entomologist, what can you find to interest you in the dissection of a beetle or butterfly? Such idle queries are constantly asked by the ignorant, to whom all things are alike—for whom there are no differences. But it is more to be lamented, that individuals extremely well informed upon one branch of science, should depreciate other branches, which they do not happen to have studied. Thus a person whose attention has not been directed to the phænomena of mind, and their connection with organic action, may feel disposed to consider discourses on such subjects as necessarily dull and unintelligible; or may pronounce upon them a very common damnatory phrase, "mere metaphysical jargon." But it would be fair to remind him, that it is far easier to condemn a science than to study it;—that a landscape might possibly be beautiful, notwithstanding a person might not choose to look at it;—and that a Chinese might consider the language of Homer and Plato an unmeaning gibberish.

As it regards the particular topics of this paper, the writer begs that their capability of affording matter for interesting meditation, may not be judged of by the manner in which he has handled them. Any obscurity or wearisome intricacy, should be charged less against the subject, than against the choice of the expressions, and the construction of the sentences.

REVIEW.

Companion to the American Almanac, 1835. 8*vo. pp.* 312. *Bowen, Boston; Bennett, London.*

It is probable that many of our readers are already acquainted with the Companion to the American Almanac, a work which is not at all inferior in character to the very useful one of a similar denomination in this country: there is, however, an article in the current number, to which we are particularly desirous of directing the attention of the public, partly from the general interest which attaches itself to the subject of Meteors, and partly on account of the views which are brought forward by Professor Olmsted, the author of the paper in question.

It appears that during the night preceding the 13th of November, 1833, a remarkable series of meteors was seen throughout the United States; commencing at about nine in the evening, and increasing in brilliancy until four in the morning, when the appearances gradually merged in the light of day; a few fireballs, however, being visible, even after the sun had risen. This exhibition was traced from the longitude of 61° in the Atlantic, to 100° in central Mexico, and from the North American lakes, to the southern side of the island of Jamaica.

The appearance was that of fireworks of the most imposing grandeur, covering the entire vault of heaven with myriads of fire-balls resembling

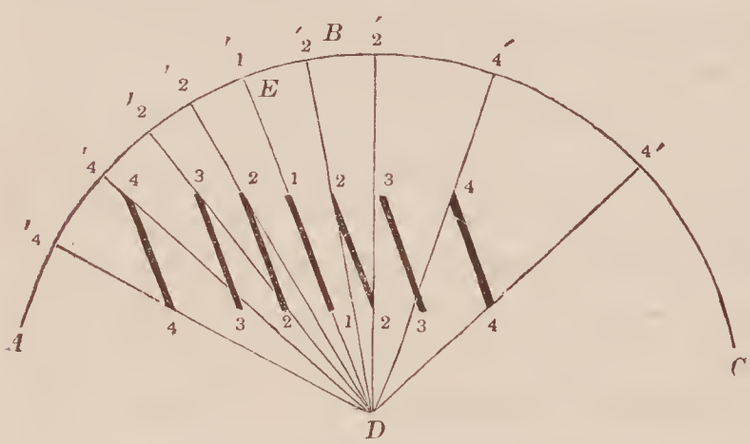
sky-rockets. These meteors were of three kinds; the first, composed of *phosphoric lines,* apparently described by a point; these were most numerous, and resembled a shower of fiery snow, driven with inconceivable velocity to the north of west: the second consisted of large *fire-balls,* darting along the sky at intervals, and leaving luminous trains, which remained for a number of minutes, or in some cases for half an hour, appearing as though the stars were falling from the sky: the third presented the appearance of undefined luminous bodies, which remained stationary in the heavens for a long time; these were of various apparent sizes and shapes. With the exception of one of these latter meteors, which is stated to have exploded with the noise of a cannon, there is no conclusive evidence that these phænomena were accompanied by any peculiar *sound;* nor is it held as a fact well established, that any substance reached the ground, which can be considered as a *residuum* or *deposit* from the meteors, although indications of such a substance were supposed to be discovered by different observers.

These meteoric phænomena were followed by remarkable anomalies in the seasons and atmospheric changes, though whether connected with each other or not is unknown. A remarkable change of weather from hot to cold, either accompanied or immediately followed, the meteoric shower. The height of one at least of the meteors of the second kind does not appear to have been considerable, since the cloud of vapour, into which it finally subsided, was apparently carried along by the wind: their general altitude, however, together with the direction in which they were projected, are points deserving of a separate consideration, and it is upon the latter that the new views of the author are brought to bear. It is remarkable that all the meteors seemed to emanate from one and the same point, that is, if their lines of direction had been continued backward, they would have met in the same point, a little south-east from the zenith. This *radiant,* or point of emanation, was observed, by those who referred its position to the stars, to be in the constellation Leo; and although by observers at remote distances it was still seen in the same constellation, yet it was in different parts of it, a change of position supposed to be due to parallax. It was first observed by Professor Olmsted, and the observation has been confirmed by others, that this radiant point was *stationary* among the fixed stars during the whole period of observation, that is, that it did not move with the diurnal revolution of the earth eastward, but accompanied the stars in their apparent progress westward. Hence, the conclusion that "*the meteors had their origin beyond the limits of our atmosphere,*" and did not therefore belong to this earth, but to the regions of space beyond it, and were independent of its rotation.

What is the height of the place whence the meteors proceeded? that is, their distance from the surface of the earth? If that place were not too distant from the earth to have a parallax, it would appear under a different

angle from different points on the earth's surface. Thus, if a northern observer marked it by a certain star, a second observer in the south would refer it to a point further north, and one in the west, further east. The difference between the angle under which it was seen by the northern and southern observers, would constitute *parallax in declination;* between the western and eastern, *parallax in right ascension;* and hence, the distance between the points of observation being known, the height of the meteor could readily be deduced. In the present instance, however, the data were imperfect and sometimes discordant; so that although 2,238 miles is the computed altitude, both Mr. Twining and Professor Olmsted are disposed to consider the real source of the meteors as considerably more distant, and at any rate, the above limit is confidently believed not to exceed the actual distance.

The meteors are supposed to have been attracted by gravity towards the centre of the earth, towards which they would therefore be drawn in parallel lines: such being the case, their apparent radiation from a common centre may thus be accounted for. Let A, B, C, represent the vault of the sky, the centre, D, being the place of the spectator. Let 1, 2, 3, 4, represent parallel lines directed towards the earth. A luminous body descending through the line D, E, coincident with the axis of vision, would appear stationary all the while at 1′; a body descending the line 2, 2, would appear to describe the short arc 2′, 2′; and a body descending the line 4, 4, would appear to describe the longer arc 4′, 4′, so that the arcs described would appear shorter or longer according as they were nearer to or further off from a coincidence with the axis of vision; those meteors whose course nearly coincided with the axis of vision, appearing to describe shorter arcs, and to move more rapidly, than others at a greater distance from it, that which might happen to fall exactly in the axis, being seen only as a luminous speck.



Professor Olmsted next proceeds to enquire, "*what velocity the meteors would acquire in falling from a point,* 2,238 *miles* (their height at the lowest computation) *above the earth, to within about fifty miles from its surface,*" this being taken as the height of the atmosphere. This would give a velocity of four miles per second, as that at which the meteors would enter the atmosphere—a velocity nineteen times that of sound. Now it is well known that when air is suddenly compressed, a quantity of heat is extricated from it, as we see in the common instrument for lighting tinder upon this principle: so that the meteors, from the rapidity with which they were moving upon entering the atmosphere, would produce a sudden

and powerful compression of the air before them, and thus extricate a quantity of heat sufficient to produce in them an intense ignition, and if they were combustible, to set them on fire.

Many of these meteors seem to have been of large size, and some of them to have descended to within a very short distance from the earth's surface, even if they did not actually reach it. They seem to have been composed for the most part of light combustible materials easily therefore dissipated in the intense heat which they extricated, and which must have been much hotter than that of the hottest furnace. Had such not been the case, or had their quantity of matter been considerable, they could scarcely have failed to reach the surface of the earth, and to have produced the most disastrous consequences. These large bodies were stopped in the atmosphere only by transferring their motion to columns of air, large volumes of which would thus be suddenly displaced, which together with the descent of cold air from the upper regions, would account for those changes of temperature and of the seasons, which followed, as well as for the violent gales by which the equilibrium was restored.

It is inferred that the nature of the meteors was the same with that of the light nebulous matter which composes the tails of comets.

To account for the production of the body which afforded the meteors, no satisfactory hypothesis seems to have been constructed; but with respect to its direction and place, it is inferred, upon data which it would exceed our limits to introduce, 1. *That the body, which afforded the meteors, was pursuing its way along with the earth round the sun.* 2. *That the body revolves around the sun in an elliptical orbit, but little inclined to the plane of the ecliptic, and having its aphelion near the orbit of the earth.* 3. *That the body has a period of nearly six months, and its perihelion a little below the orbit of Mercury.*

The substance of the above paper, together with the reasoning on which the conclusions are founded, will be found in one of the most valuable periodicals of the present day, The American, or Silliman's Journal of Science.

M. Aimé on a New Method of Making Magnets.

The appearance of a new number of Les Annales de Chimie et de Physique, enables us to bring forward an interesting note by M. Aimé, upon a subject towards which the discoveries of Dr. Faraday and others, have directed a share of public attention in this country.

Such of our readers as are at all conversant with the phænomena of electro-magnetism, are probably aware, that the chemical decompositions and recompositions effected by the voltaic pile, may be effected also by a proper magnetic apparatus: but such an apparatus, although easier of application than that of Volta, requires powerful magnets, and as these are difficult to be procured, has been but seldom employed. It is to obviate

this difficulty that the paper, the substance of which we are about to present to our readers, has been directed.

M. Aimé proposes to bestow temper and magnetism at once upon a bar of steel, in the following manner.

Let a horse-shoe shaped bar, of soft iron, be encircled with a brass wire, covered with silk; let the two extremities of this wire be connected with the poles of a voltaic battery; take a straight bar of steel, long enough to connect the two limbs of the horse-shoe, and heat it to a red heat; then with a pair of pincers, apply the ends of the bar to those of the horse-shoe, and plunge the whole into cold water. After an immersion of a minute or two, remove the first bar, and repeat the process with others, drawn successively from the fire.

Lest the wire should be injured, the two extremities of the coil, when the apparatus is dipped into the water, should be enveloped in linen covered with mastich. The ends of the conducting wire should also be soldered to the zinc and copper poles of the battery. A single wire has been employed; it would perhaps be preferable to unite many such into a bundle, or to use a strip of copper, covered over with silk or varnish.

The bar should not be detached too rapidly from the horse-shoe; it is necessary to wait until the interior of the steel is of a very reduced temperature, so that its molecules may be disposed properly for magnetism and temper.

The time of the immersion should always be short, though varying with the bulk of the bar, and the temperature at which it is applied. We have thus an easy method of procuring any number of magnetised steel bars. By this method may also conveniently be prepared magnets, "en faisceau," and perhaps compass needles, since it affords a facility for magnetising almost as powerfully bars of a hard, as those of a softer temper.

The above process may be applied also to masses of the magnetic oxide of iron; only, it is perhaps more advantageous not to temper them.

The two effects are upon trial. In neither case is it very probable that the condition of the oxidation of the surface is in any great degree modified by the elevated temperature, especially when precautions, which it is easy to imagine, are taken against the presence of the oxygen of the atmosphere.

A Treatise on the principal Mathematical Instruments used in Surveying, Levelling, Astronomy, &c. By F. W. Simms. London, Troughton and Simms, 1834. *pp.* 108.

This is a short tract, wherein the principal mathematical instruments in use among surveyors and astronomers are enumerated, described, and figured, and the method of employing them concisely explained. The

mode of protracting work upon paper after the completion of the actual survey, occupies the appendix, and to the whole are added tables for the convenient computation of barometrical measurements of altitude, conversion of mean solar into sideral time, &c.

This tract conveys more information upon the above subjects, within a small compass, and at a lower cost, than any other extant. It will be found extremely useful to scientific travellers, as well as to those who may be occasionally called upon to employ instruments, with the use of which practise has not rendered them familiar.

Should, when at a distance from the maker, any mishap befall an instrument, the instructions here laid down will give the owner some chance of being able to amend it. "But," as Mr. Troughton observes, on concluding some instructions of his own, "should these hints set any over-handy gentleman on tormenting his instrument, it will not be what was intended by them; they were added, that in case of accident, those who are so unfortunate, might be enabled thereby to put their own instrument in order."

QUARTERLY HORTICULTURAL REPORT.

Pelargonium Speculum Mundi is a seedling raised at the Nursery from seed saved in 1833. This hybrid has been in bloom in very great perfection, and has been much admired. Its flowers, which are from seven to ten in each umbel, and measure above three inches across, are of a purple crimson colour, elegantly and regularly reticulated over every part of the petals of a darker hue. The flower stalks are erect and strong, and able to support double their ordinary number of flowers. The leaves, somewhat kidney-shaped, are of a healthy green, and with every other part of the plant covered with fine silky hair. The plant is of excellent habit, and is probably among the most attractive of this now very numerous genus.

Amongst many other seedling pelargonia which have flowered this spring, is one which has been named P. Splendidissimum; and as far as a judgment can at present be formed from the seedling plant, it will be equally worthy of cultivation with the former, though of a very different character. Its flowers are of a bright rosy red, with two large black spots on the upper petals. It is, however, better to defer giving a description of this seedling until a second flowering has been witnessed.

Passiflora Quadrangularis, or *Granadilla Vine.* This plant, which was put out in one of the pine stoves in the autumn of 1833, has grown with great luxuriance, having at this time upwards of a dozen very large fruits upon it, many of which measure between twenty-one and twenty-two inches in circumference, which are now ripe, weighing from seven to eight pounds each.

Mr. Sabine describes the fruit (Horticultural Transactions) as "very

large, of an oblong shape, above six inches in diameter from the stalk to the eye, and fifteen inches in circumference; it is externally of a greenish yellow when ripe, soft and leathery to the touch, and quite smooth; the rind is very thick and contains a succulent pulp of a purple colour, (which is the edible part) mixed with the seeds, in a sort of sac, from which it is readily separated. Wine and sugar are commonly added to it when used. The flavour is sweet and slightly acid, and it is very grateful to the taste, and cooling in a hot climate. It is a native of Jamaica and other West India islands."—(Loudon's Encyclopædia.) The beautiful and fragrant bloom and broad deep green foliage of this species of Passiflora are too well known to need description; but I have never seen it bear fruit before to so much advantage.

In the green houses at the Nursery, the following plants have been in bloom this season:—

Cactus speciosissimus, with 90 perfect flowers.
——— hybridus, „ 130 ditto.
——— Jenkinsoni, „ 100 ditto.
——— Ackermanni major, a fine specimen.
Tropæolum pentaphyllum, a beautiful climber.
Clivia nobilis, a new plant which never before bloomed in this neighbourhood.
Nemophila insignis, a very lovely green-house annual.
Petunia Milleri, a seedling raised at the Nursery last year; very showy, and intermediate between P. Nyctaginiflora and P. Phœnicea. It is also fragrant.
Boronia Serrulata.
Selago Gillii. } Three beautiful green-house plants.
Mirbelia Baxterii.
Amaryllis. Johnsoni.
——— Vittata elegans.
——— ——— tubiflora.
——— Semperflorens.
——— A new seedling variety, between Rubescens and Consanguinea.
Pimelea hispida. A very fine specimen.
Helichrysum proliferum.
Astelma eximia.
Epacris grandiflora, a splendid specimen.
Erica Hibbertiana, a remarkably strong-grown specimen.
Calceolaris, an innumerable variety, and some very beautiful seedlings.
Pelargonia, almost all the varieties in the country.

The following plants have generally been kept under glass, and have, at the Nursery, stood the winter well without protection; and some of them are now in strong foliage and beautiful bloom:—

Swainsonia galegifolia. } From N. S. W.; against an open wall for four
——— astragalifolia. } years.

Mutisia superba.	„	Brazil.
Capparis spinosa.	„	S. Europe.
Acacia Verticillata.	„	Van Dieman's Land.
Erythrina laurifolia. ——— crista galli.	„	Brazil.
Salvia fulgens. ——— chamædryoides. ——— Grahami.	„	Mexico.
Convolvulus brioniæfolius.	„	China.
Bignonia grandiflora.	„	China.
Alstrœmeria hirtella. ——— psittacina.	„	Mexico.
——— Simsii.	„	Chili.
——— Acutifolia.	„	S. America.
——— Pelegrina. ——— albida.		Peru.

The following Cape bulbs have also done well with us:—

Crinum capense.

Crinum riparium, a hybrid from High Clere, Lord Caernarvon's; strong, growing, and in fine bloom.

Brunsvigia Josephinæ.

——— Toxicaria.

——— Multiflora.

——— Falcata.

Valotta Purpurea, and

Anomatheca Cruenta, an exceedingly pretty flowering bulb.

We have also had a very fine bloom of North American plants, and of the new Ghent Azaleas. In the herbaceous borders there has been a new Pæony, (Pæonia Anemoniflora,) and a very great variety of New Pansies, or Heart's-ease, which have attracted much notice.

A very numerous collection of dwarf and standard roses are now in great perfection.

M. Mayes.

Bristol Nursery, June 6, 1835.

TIDE GAUGE REGISTER,

Erected on the Estate of Richard Bright, Esq., Hung Road, River Avon.

The time of the following Tables is mean time at Bristol, as shewn by the clock at the Philosophical Institution; the Register being thence corrected from the errors of the machine clock. The height is calculated from Zero, which is ten feet above the bottom of the river at the middle.

It will be observed, that the time of low water during spring tides is not given; this is in consequence of the gauge being necessarily above the level to which such tides fall in the Channel.

J. D. Sheriff.

1835. JANUARY.		HIGH WATER. TIME. h.	m.	HEIGHT. ft.	in.	LOW WATER. TIME. h.	m.	HEIGHT. ft.	in.	WIND.	LUNATIONS. h.	m.
1	A. M.									N.		
	P. M.	9	0	35	9	..		..				
2	A. M.	9	30	35	6					N. E.		
	P. M.	9	36	33	10	..		..				
3	A. M.	10	15	34	0					E.		
	P. M.	10	25	32	9	..		..				
4	A. M.	10	30	32	5					N.		
	P. M.	10	35	30	6	..		..				
5	A. M.	11	0	30	3					N. E.		
	P. M.	11	15	28	6	..		..				
6	A. M.	11	30	28	2	5	20	2	1	E.		
	P. M.	11	38	27	2	5	35	2	7		☽	9 41
7	A. M.	11	53	27	0	5	40	4	4	E.		
	P. M.					6	10	4	3			
8	A. M.	0	25	25	3	6	15	5	7	E.		
	P. M.	0	38	26	0	6	48	5	0			
9	A. M.	1	15	24	10	7	0	7	0	S. W.		
	P. M.	1	35	27	5	7	38	7	9			
10	A. M.	2	10	25	4	8	15	5	9	S. W.		
	P. M.	2	30	26	6	8	45	5	0			
11	A. M.	2	55	28	6	9	30	5	1	S. W.		
	P. M.	3	34	29	3	9	48	3	6			
12	A. M.	4	4	30	0	11	45	2	10	S. W.		
	P. M.	5	50	31	1							
13	A. M.	6	0	32	0					E.		
	P. M.	6	30	33	3	..		..				
14	A. M.	6	35	34	5					S. E.		
	P. M.	6	45	34	11	..		..			○	9 16
15	A. M.	7	0	35	7					S. W.		
	P. M.	7	15	36	3	..		..				
16	A. M.	7	43	37	6					W.		
	P. M.	8	0	37	0	..		..				
17	A. M.	8	10	37	7					W.		
	P. M.	8	33	36	8	..		..				
18	A. M.	9	0	36	10					N. E.		
	P. M.	9	22	35	7	..		..				
19	A. M.									N. W.		
	P. M.	10	30	34	0	..		..				
20	A. M.	10	40	31	4					N.		
	P. M.	11	5	33	2	..		..				
21	A. M.	11	20	32	9					N.		
	P. M.	11	30	31	7	..		..			☾	8 56
22	A. M.	11	45	31	2					N. W.		
	P. M.					6	15	2	3			
23	A. M.	0	15	29	6	6	42	3	0	W.		
	P. M.	1	0	29	10	6	57	3	6			
24	A. M.	1	30	29	1	7	30	4	0	W.		
	P. M.	2	0	29	9	8	18	3	3			
25	A. M.	2	38	30	7	9	0	3	2	W.		
	P. M.	3	13	30	5	9	33	2	2			
26	A. M.	3	58	31	9					W.		
	P. M.	5	25	31	4	..		..				
27	A. M.	6	5	33	6					S. W.		
	P. M.	6	32	33	10	..		..				
28	A. M.	6	47	35	4					S. W.		
	P. M.	7	3	35	5	..		..			●	9 12
29	A. M.	7	18	36	5					S. W.		
	P. M.	7	34	36	6	..		..				
30	A. M.	7	45	37	0					S.		
	P. M.	8	5	36	4	..		..				
31	A. M.	8	18	36	5					S. E.		
	P. M.	8	34	36	0	..		..				

1835. FEBRUARY.		HIGH WATER. TIME.		HIGH WATER. HEIGHT.		LOW WATER. TIME.		LOW WATER. HEIGHT.		WIND.	LUNATIONS.		
		h.	*m.*	*ft.*	*in.*	*h.*	*m.*	*ft.*	*in.*			*h.*	*m.*
1	A. M.	8	38	36	5								
	P. M.	8	54	35	0	..		..		S.			
2	A. M.	9	25	34	5								
	P. M.	10	20	33	0	..		..		S. W.			
3	A. M.	10	46	33	1								
	P. M.	10	50	31	6	..		..		W.			
4	A. M.	11	3	30	8								
	P. M.	11	19	29	8	..		..		W.			
5	A. M.	11	28	29	4	5	38	3	0				
	P. M.	11	45	27	3	5	50	5	0	W.	☽	7	36
6	A. M.					6	6	6	10				
	P. M.	0	16	26	10	6	17	5	9	N. W.			
7	A. M.	0	37	26	4	6	23	7	9				
	P. M.	0	43	24	9	7	3	8	0	W.			
8	A. M.	1	8	25	7	8	9	10	0				
	P. M.	1	29	26	6	8	20	9	0	W.			
9	A. M.	2	50	25	9	10	10	5	6				
	P. M.	4	30	27	6	10	30	5	10	N. W.			
10	A. M.	4	35	27	10	11	8	3	0				
	P. M.	5	12	30	2	12	0	2	11	N.			
11	A. M.	5	45	30	8								
	P. M.	6	8	32	5	0	50	2	3	S. W.			
12	A. M.	6	23	34	0	1	23	2	3				
	P. M.	6	55	34	6					W.			
13	A. M.	7	26	36	0								
	P. M.	7	40	36	10	..		..		N. W.	○	11	0
14	A. M.	7	55	37	5								
	P. M.	8	15	37	10	..		..		W.			
15	A. M.	8	30	39	0								
	P. M.	9	0	39	0	..		..		W.			
16	A. M.	9	10	38	11								
	P. M.	9	45	38	8	..		..		W.			
17	A. M.	10	5	39	6								
	P. M.	10	27	38	10	..		..		W.			
18	A. M.	10	32	38	5								
	P. M.	11	3	37	4	..		..		W.			
19	A. M.	11	20	36	3								
	P. M.	11	49	34	0	5	42	4	8	S. W.			
20	A. M.					6	42	5	6				
	P. M.	0	20	33	9	6	45	5	8	S. W.	☾	4	52
21	A. M.	0	36	31	11	7	0	6	6				
	P. M.	1	22	31	8	7	38	7	7	S. W.			
22	A. M.	1	53	29	10	8	9	6	6				
	P. M.	2	37	29	9	8	20	8	6	S. W.			
23	A. M.	3	6	32	4	10	5	10	3				
	P. M.	4	10	28	3	10	40	6	8	W.			
24	A. M.	4	40	32	0	11	30	4	8				
	P. M.	5	18	34	0					W.			
25	A. M.	5	43	36	2	0	3	4	8				
	P. M.	6	3	34	9	0	13	4	8	S. W.			
26	A. M.	6	9	37	11								
	P. M.	6	35	38	9	..		..		S. W.			
27	A. M.	7	0	40	1								
	P. M.	7	24	40	4	..		..		S. W.	●	0	28
28	A. M.	7	47	39	8								
	P. M.	8	18	39	9	..		..		N. W.			

1835. MARCH.		HIGH WATER. TIME. h.	m.	HEIGHT. ft.	in.	LOW WATER. TIME. h.	m.	HEIGHT. ft.	in.	WIND.	LUNATIONS. h.	m.
1	A. M.	8	24	40	4							
	P. M.	8	29	36	9	..		..		N. W.		
2	A. M.	8	40	38	10							
	P. M.	9	15	38	0	..		..		W.		
3	A. M.	9	25	39	3							
	P. M.	9	38	37	0	..		..		W.		
4	A. M.	9	47	37	9							
	P. M.	9	58	36	2	..		..		S. W.		
5	A. M.	10	21	34	3	4	3	4	6			
	P. M.	10	34	34	11	4	12	4	7	W.		
6	A. M.	10	45	32	8	4	43	6	7			
	P. M.	10	58	32	0	5	10	5	1	N. W.		
7	A. M.	11	7	30	10	5	22	9	4			
	P. M.	11	28	27	9	5	37	7	5	S. W.	☽ 4	12
8	A. M.					5	40	9	7			
	P. M.	0	8	26	10	6	10	9	8	W.		
9	A. M.	0	10	27	10	6	12	11	4			
	P. M.	1	10	25	11	7	22	12	7	S.		
10	A. M.	2	0	26	4	8	0	11	11			
	P. M.	2	50	28	0	9	0	9	3	W.		
11	A. M.	3	15	31	0	10	20	8	6			
	P. M.	4	0	31	3	10	55	6	5	S. W.		
12	A. M.	4	20	33	4	11	25	5	8			
	P. M.	4	35	35	9					N. E.		
13	A. M.	5	27	36	6	0	22	7	4			
	P. M.	5	45	37	10					S. W.		
14	A. M.	5	52	39	2							
	P. M.	6	17	39	7	..		..		S. W.	○ 10	7
15	A. M.	6	53	41	0							
	P. M.	7	22	41	9	..		..		N. W.		
16	A. M.	7	43	42	8							
	P. M.	8	23	42	3	..		..		W.		
17	A. M.	8	34	42	11							
	P. M.	8	47	41	9	..		..		S. W.		
18	A. M.	8	57	40	11							
	P. M.	9	18	40	0	..		..		N.		
19	A. M.	9	32	39	0							
	P. M.	9	44	37	8	..		..		N.		
20	A. M.	10	13	36	5							
	P. M.	10	36	34	6	..		..		S. W.		
21	A. M.	10	44	32	10							
	P. M.	11	8	30	8	5	8	5	3	W.	☾ 1	26
22	A. M.	11	54	29	0	5	29	5	2			
	P. M.					5	45	6	1	N. E.		
23	A. M.	0	45	27	5	6	30	6	0			
	P. M.	2	0	26	11	8	0	6	10	N. E.		
24	A. M.	3	0	27	9	9	0	5	3			
	P. M.	3	40	28	7	10	20	4	7	N. E.		
25	A. M.	4	30	31	2	11	10	4	1			
	P. M.	5	0	31	5	11	50	4	2	N. E.		
26	A. M.	5	23	33	8							
	P. M.	5	38	34	5	..		..		N. E.		
27	A. M.	5	48	36	4							
	P. M.	6	10	36	5	..		..		N. E.		
28	A. M.	6	30	37	6							
	P. M.	6	40	37	3	..		..		N. E.		
29	A. M.	6	55	38	3							
	P. M.	7	0	38	0	..		..		E.	● 4	42
30	A. M.	7	20	38	9							
	P. M.	7	52	38	6	..		..		Variable.		
31	A. M.	8	20	39	0							
	P. M.	8	30	38	8	..		..		S.		

METEOROLOGICAL TABLE,

For the months of APRIL, MAY, *and* JUNE, 1835, *kept on Nine-tree Hill, Kingsdown, Bristol.*

Apl.	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·89	66	47		S.	Fine
2	·83	67	51	0·11	Vrble.	Changeable, Thunder
3	·75	64	46	0·14	S. W.	Changeable
4	30·06	62	49	0·06	S. W.	Rain
5	·10	61	49		S. W.	Cloudy
6	·28	64	43		S.	Ditto
7	·28	66	44		S.	Fair
8	·28	63	47		S. W.	Fine
9	·19	63	48		S. W.	Hazy
10	·18	63	40		N. W.	Fine
11	·31	54	34		N.	Ditto
12	·26	54	35		Vrble.	Ditto
13	·14	59	37		S. W.	Ditto
14	·13	56	37		W.	Ditto
15	29·93	60	29	0·03	Vrble.	Changeable
16	30·23	48	28		Vrble.	Ditto, with Hail
17	·15	47	30		N.	Fair. Snow, A. M.
18	·08	54	42		N. W.	Cloudy
19	·29	59	39	0·02	Vrble.	Ditto. Rain at night
20	·45	63	44		W.	Fine
21	·45	64	43		W.	Fair
22	·40	63	41		N.	Ditto
23	·43	61	44		N.	Ditto
24	·36	62	43		N.	Fine
25	·16	55	36	0·03	N. W.	Fair. Rain at night
26	29·74	49	27	0·01	N.	Chble. Hail & Snow
27	·62	53	29		Vrble.	Fair. Light Rain, P.M.
28	·82	52	37		N. E.	Fine
29	·69	49	42	0·32	N. E.	Rain
30	·54	50	40	0·30	N. E.	Ditto

May	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·62	53	44	0·09	Vrble.	Drizzling Rain
2	·62	62	42	0·01	W.	Fine. Rain at night
3	·78	60	41		W.	Fair
4	·86	63	38		W.	Fine
5	30·02	64	50	0·07	S. W.	Ditto. Rain at night
6	29·83	66	43		S. W.	Fair
7	·94	65	48	0·01	W.	Ditto
8	30·04	68	51	0·02	S. W.	Cloudy. Rain, A. M.
9	29·88	67	49	0·28	S.	Changeable
10	·77	68	43		W.	Ditto
11	·94	69	48	0·13	W.	Fair. Rain at night
12	·79	69	49	0·05	S. W.	Ditto
13	·62	67	48	0·30	W.	Ditto
14	·43	64	40	0·05	S. W.	Fine. Rain, A. M.
15	·63	64	44	0·25	S. W.	Changeable
16	·71	63	48	0·14	S. W.	Ditto
17	·83	60	50		S.	Cloudy
18	·82	67	52		S.	Fair. Rain at Night
19	·80	61	51	0·27	Vrble.	Rain
20	·90	65	52		Vrble.	Fair
21	30·15	66	55		N. E.	Fine
22	·12	65	54		W.	Fair. Rain, P. M.
23	·07	67	54	0·01	S. W.	Fine
24	29·98	67	53	0·10	S. W.	Fine. Rain at night
25	·84	66	48	0·37	S. W.	Fair. Rain at night
26	·50	67	46		W.	Fine. Rain, A. M.
27	·66	68	45	0·01	Vrble.	Changeable, Thunder
28	·88	65	42	0·15	Vrble.	Ditto Ditto
29	30·03	62	41		N. E.	Fine
30	·09	59	38		N. E.	Ditto
31	29·96	68	46	0·37	S. W.	Ditto. Rain, A. M.

June	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·88	64	45		Vrble.	Changeable
2	·96	67	50		S. E.	Fair
3	·86	70	46		S.	Fine
4	·97	70	54		N. E.	Fair
5	30·07	65	55		N. E.	Fine
6	·04	74	58	0·11	N. E.	Fair, A.M. Thunder, &c
7	·06	77	57	0·03	Vrble.	Fine. Ditto
8	·05	77	57	0·01	Vrble.	Ditto Ditto
9	·15	79	56		W.	Ditto Ditto
10	·23	80	58		W.	Fine
11	·30	76	57		W.	Ditto
12	·33	78	60		N.	Ditto
13	·26	72	56		N. E.	Fair
14	·14	74	59		N. E.	Fine
15	·17	82	57		Vrble.	Ditto
16	·22	83	58		Vrble.	Ditto
17	·10	80	51		S. W.	Ditto
18	·09	70	50		N. E.	Ditto
19	·14	73	50		Vrble.	Ditto
20	29·97	75	50		W.	Ditto
21	·99	74	44		W.	Ditto
22	·79	75	45	0·19	W.	Fair. Rain, P. M.
23	·66	71	45	0·11	W.	Fine. Rain, P. M.
24	·26	67	44	0·17	Vrble.	Rain
25	·50	70	42		N. W.	Rain, A.M. Fair, P.M.
26	·82	64	43	0·66	S. W.	Rain. Thunder, P.M.
27	30·00	67	41	0·05	N. W.	Hail, A.M. Fine, P.M.
28	·20	68	43		Vrble.	Fine
29	·15	69	51		Vrble.	Fair
30	·02	69	53		S. E.	Ditto

The mode of taking the observations is as follows:—The Barometer (with an open cistern) is noted every morning at nine o'clock, and its height placed opposite to the day of the month; but the Thermometer and Pluviometer, which are also examined at the same time, have their results recorded opposite to the date of the day preceding, consequently they apply to a period of twenty-four hours, beginning at nine, A. M. on the day indicated. The Wind is noted by observations on the highest and best vanes of the churches in the city; and when more than one direction is observed during the day, the word Variable is used. The Weather noted is the general character of the day.

Small Street, Bristol.

EDWARD JONES.

DONATIONS

TO THE

BRISTOL PHILOSOPHICAL AND LITERARY INSTITUTION,

Since April 1st, 1835.

MAMMALIA.

Mr. J. S. Stutchbury, *Demerara.*—Bradypus tridactylus, or Three-toed Sloth (fœtus); Black Spider Monkey, *(Ateles paniscus,)* from Demerara.

T. Wittenbury, Esq., R. N.—A specimen of the Great Bat, *(Pteropus Edulis,)* from the East Indies.

John Miller, Esq.—Specimen of the small Agouti, from Demerara.

BIRDS.

Swinfen Jordan, Esq., *Rio de Janeiro.*—Sixty Skins of Humming Birds, among them the following species:—Trochilus albicollis, rubineus, glaucopis, niger, prasina, Buffonii, cyanus, amethystinus, magnificus, cyanagenys, Waglerii, amethystoides, Delalandii, saphirinus, superciliosus, cirrochloris, &c. These are in addition to a similar donation last year.

John Miller, Esq.—Specimen of the Crax Alector, or Currassow Bird.

John Bush, Esq.—Specimen of the Sheldrake.

Mr. A. Woolcott, *Pasca, Peru.*—Several Bird's Skins, in addition to various specimens sent last year.

REPTILES.

Mr. Wm. Muller.—Two specimens of Lacerta Agilis.

Capt. Weir, *Ship Nelson.*—A fine specimen of the Sauve Guard Lizard; Coral Snake, Tortrix Scytale; and the Bush Master, *(Vipera,)* from Demerara.

Mr. S. Stutchbury.—A newly-discovered Lizard, the Holoderma horrida, (Wagler) from California. Two other specimens only known—one in the British Museum, the other in the Imperial Collection at Berlin.

MOLLUSCA.

Miss F. M. Phillips.—Twenty-five Species of British shells, namely, Scalpellum vulgare, Balanus punctatus, Pholas candida, P. papyracea, P. lamellata, P. parva, P. hians, Solen vagina, S. pellucidus, Gastrochæna dubia, Lutraria compressa, L. oblonga, Cardium tuberculatum, C. echinatum, C. aculeatum, Isocardia Cor, Venus ornata, V. reflexa, Amphidesma Boysii, Anatina intermedia, A. distorta, Petricola irus, Nucula margaritacea, Pecten varius, Pinna ingens, with its byssus.

William Lee, Esq.—A magnificent specimen of the splendid Ear Shell, Haliotis splendens, from California.

Capt. Potter, *Ship Congo.*—Two specimens of Avicula, from Africa.

OSTEOLOGY.

Captain Wray, *Ship Justinian.*—Specimen of the Lemur, from Madagascar, for skeleton.

Capt. Weir, *Ship Nelson.*—Specimen of a young Peccary, or Bush Hog, from Demerara, for skeleton.

Mr. J. S. Stutchbury, *Demerara.*—Skull of the South American Tapir, *(Tapir Americanus)* native name, *Myapouri.*

Richard Smith, Esq.—Various Animals' Teeth, &c.

Capt. Wilcox, *Ship Pomona.*—A large specimen of the Snout of a Saw Fish, from Trinidad.

GEOLOGY.

Wm. Clayfield, Esq.—A Cast in plaster of a very large Trilobite, Calymene Blumenbachii, from Dudley.

Wm. Raddon, Esq.—Various Fossil Shells, from various localities.

Capt. Maflin.—A piece of an old Fort at Gallipoli, built by the Genoese, forming a singular breccia of sand shells and pebbles.

Thos. Allis, Esq., *York.*—Various specimens of Coal Shale Fossils, from the upper Yorkshire Coal Fields, among them the following :—Sphenopteris denticulata, Brong., Sphenopteris latifolia, Pecopteris curtata, (Phillips's, Yorkshire,) Pecopteris Williamsonii, of Br. Pecopteris Whitbiensis, Br. Lycopodites uncifolius, Scolopendrum solitarium, Flabellaria viminea, (Phillips, vol. 1.) Cycadites pecten, Phragma of Equisetum columnare, Joint of Equisetum columnare, Thuytes expansus, and nine others.

John Leman, Esq., *Risca.*—Various Coal Shale Fossils, from Risca, Monmouthshire; among them, Sphenopteris Conwayii, of Lindley; Sphenopteris latifolia, Stigmaria, &c.

MINERALOGY.

Rev. — Dymock, *of Wrington.*—Two Specimens of Crystallized Murio-arseniate of Lead, Cumberland; two ditto of Crystallized Blende, with Pearl and Brown Spar, from ditto; a large and fine Crystallized Sulphate of Barytes, with Barytocalcite; and a specimen of Wolfram.

J. Moens, Esq., *Arequipa, Peru.*—A rich and fine specimen of Muriate of Silver, partially crystallized; Ditto of Sulphuret of Silver; ditto Plumbiferous Silver, with crystallized Brown Spar; Native Gold, in Quartz; Red Sulphuret of Silver, with crystallized Sulphate of Barytes, and three other Silver Ores, all from Peru.

Wm. Raddon, Esq.—Three specimens of Hydragillite, from Barnstaple; Crystallized Black Tourmaline, Bovey.

MISCELLANIES.

G. W. Braikenridge, Esq.—Model in plaster of the Tomb of Cannynge in St. Mary Redcliffe Church.

T. M. Woodward, Esq.—A Helmet; a chased Cuirass (Milan); together with other portions of armour.

Henry Daniel, Esq.—Four specimens of Ancient Peruvian Pottery, of various forms.

John Moens, Esq., *of Arequipa, Peru.*—Three specimens of Ancient Peruvian Pottery, and a Dish; also two Models of Natives of Cuzco, made by the natives in knitted silk.

COINS.

Robert Flamank, Esq., *Mayor of Bodmin,* per Nicholas Roch, Esq.—A Silver Medal, presented by Queen Ann to Miss Honor Tomb, of Bristol, on the occasion of her Majesty's visit to Bristol, as being a freeman's daughter; she was afterwards the wife of Wm. Hodge, Ironmonger, of Bodmin.

Ben. H. Bright, Esq.—Bronze Medal, by Wyon, of Sir John Soane;—"A tribute of respect from the British Architects."

Mr. Parkman.—An ancient English Token, found in digging a grave in St. James's Churchyard.

Geo. G. Francis, Esq., *Swansea.*—Twenty-nine Coins, (Roman small brass) found in an urn, June, 1835, near the copper works in the parish of Lansamlet, on the east side of Swansea river: among them are coins of the following, Gallienus, Tetricus Ang., Victorinus Ang., and Claudius Gothicus.

BOOKS.

Western Literary and Scientific Institution, London.—The Literary Union, a Monthly Magazine, Nos. 1 and 2, 1835.

The Author.—"Descriptions of some New Species of Calyptræidæ," and "On Clavagella," being Papers read before the Geological Society, by W. J. Broderip, Esq., 1834.

Jerh. Hill, Esq.—Recreatio mentis et oculi in observatione Animalium testaceorum, &c. by Philippo Bonanno, 1 vol. 4to., Romæ, 1684.

Dr. L. Booker.—A Copy of his Work, "The Mitre Oak," a Poem, 4to., Birmingham.

G. Cumberland, Esq.—The Twelfth Report of the Whitby Literary and Philosophical Society, 8vo. 1834.

The Geological Society of London.—Their Proceedings, No. 36 of vol. ii., and a Letter to the President and Members of the Society, in answer to certain Observations contained in Mr. Greenough's Anniversary Address of 1834, by Mrs. Callcott, London, 1834.

The Editor.—Nos. 1 and 2 of the West of England Journal.

WEST OF ENGLAND JOURNAL

OF

SCIENCE AND LITERATURE.

No. IV. OCTOBER, 1835. Vol. I.

PART I.—SCIENCE.

REFLECTION AND REFRACTION OF LIGHT,

As explained by Newton, Huygens, and a new Theory, in order to form a Comparison.

BY THOMAS EXLEY, A. M.

(Concluded from page 148.*)*

14. The Huygenian theory makes the phænomena of light to depend on the vibrations, or displacements of the particles constituting an universal ether, supposed to occupy the interminable regions of space. See art. 6.

The displacements themselves are considered as exceedingly small, so that neither the agitated atoms of the ether, nor those of the exciting bodies, become detached, or change their order among the neighbouring particles. Herschel *on Light*, art. 568. The vibrations originally excited by the luminous body, produce successive waves, which are supposed to follow each other with perfect uniformity, swelling and extending themselves in every direction spherically, while they advance through space, till lost in the infinity of their progress.

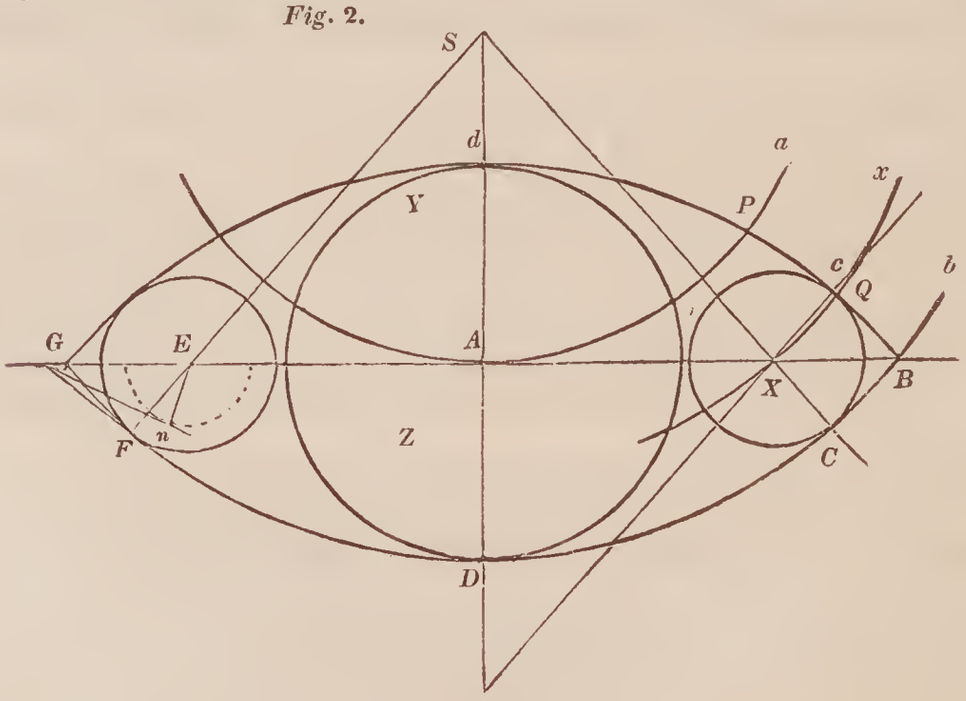
15. The distance between the external and internal surface of a wave is called a pulse or undulation; its length is measured from any particular phase in one wave to the same phase in the next succeeding or following one; as for instance, from the greatest condensation or rarefaction to the next greatest condensation or rarefaction; it is exactly double the length of the Newtonian fits of easy reflection and transmission, as determined by the fine experiments of that prince of philosophers. Thus the length of a wave or pulse for red light, or that least refracted, is about the forty thousandth part of an inch, and about the sixty thousandth part of an inch for violet light, which is most refracted. In each wave the particles of ether

oscillate, but the length of the vibration, and that of the wave are distinct things.

The direction of a ray is a line perpendicular to the surface of a wave, that is to its front, the surface in which all the phases are the same; hence, in uniform media, light will appear to advance in a rectilinear course, from the centre of the spherical wave. The velocity with which the waves are propagated through space, that is, the velocity of light, depends on the elasticity of the medium, and not on the velocity, or on the amplitude of excursion of the vibrating particles; it is greater or less according as the elasticity is more or less perfect; hence in a given medium the velocity of light is constant, which is in accordance with the first fact, stated art. 12. The intensity of light, or the quantity or degree of illumination on a given surface, is, in this theory, measured by the square of the amplitude of excursion of the vibrating molecule; the sense of vision being supposed to be affected by the vibrations, more or less, according to the magnitude of this square.

16. To explain reflection, and refraction of light at the surface of a new medium, the vibrating particles are supposed to impinge on those of the medium, in a manner analogous to that of an elastic ball striking another on which it falls: when the media have the same degree of elasticity, the vibrations are propagated forward without any reflection or deviation: but when the media have different degrees of elasticity, every point on the surface becomes a new centre of vibrations, propagating spherical waves, and thus producing at once both reflection and transmission.

Fig. 2.



Let *S*, fig. 2, be the source of light traversing the medium *Y*, and meeting the surface of the new medium *Z* in the line *A B*; if the elasticity of the ether in *Y* and *Z* be the same, the spherical wave *A P a*, touching the surface at *A*, will advance uniformly in its course, passing *X Q x*, *D C B*, &c. and no reflection, it is said, will occur. When the elasticities

are different, the several points in $A\,B$, as A, X, &c. will become the centres of new spherical waves, which in the same medium Y, will move with the same velocity, so that when $A\,P\,a$ would have attained the position $D\,B\,b$, the new hemispherical wave excited at A, will have come exactly to d, making the radius $A\,d$ equal to $A\,D$ or $P\,B$; and the wave excited at X, will at the same time have arrived at c, so that $X\,c$ shall be equal to $X\,C$, or $Q\,B$, the distance the original wave would have advanced had there been no interruption: similarly will spherical waves be excited at every point of the surface, and thus propagated by reflection into the first medium. Let the circles be completed, and suppose the original wave had arrived at the position $D\,C\,B\,b$, it is manifest that the spherical surfaces, $D\,C\,B$, and $C\,c$, will touch each other at C, the extremity of the common radius $S\,X\,C$; therefore the point c, will be in contact with a similar and equal spherical surface $G\,d\,c\,B$ in the first medium: the same will hold good for the waves excited at every point in the surface, as shewn for that at X, hence the series of contacts will constitute the spherical wave $G\,d\,c\,B$. Now to an eye at X, or C, the object or luminous point is seen at S, and consequently to an eye at c, the reflected image is seen at s, making the angle of reflection $X\,s\,S$ equal to the angle of incidence $s\,S\,X$, and in the same plane $S\,A\,X$.

Refraction on this hypothesis is thus explained; let Z be the denser medium, then will the elasticity, and the velocity in it be less than in Y, (post. 3, art. 6) therefore the radius of a spherical wave produced in its surface at any point as E, will be less than in the first medium; let it be $E\,n$, while the former would have been $E\,F$, had the same elasticity and consequently the same velocity continued: from F draw the tangent $F\,G$, and from G, draw the tangent $G\,n$ to the new spherical surface; then $E\,F$ is perpendicular to the front of the original wave at F, and $G\,n$ is perpendicular to that excited in the new medium at n; now it is manifest, that $E\,G\,F$ is equal to the angle of incidence, and $E\,G\,n$ to the angle of refraction; and that $E\,F$ and $E\,n$ are the sines of those angles to the radius $G\,E$, but these lines are in a given ratio, viz. that of the velocities, which depend on the elasticities of the two media; hence the sines of incidence and refraction are in a given ratio. These explanations satisfy the second, third, fifth, and sixth of the facts stated art. 12, and the fourth partially, but for the absorption of light, or indeed for the scattering of its rays at the point of incidence, this theory assigns no complete and adequate cause.

These explanations of reflection and refraction, it is admitted, are not free from obscurities and defects; arising from our total ignorance of the kind of vibratory motion, supposed to be excited, and also from the circumstance of the vibrations diverging in all directions. That the quantity of reflected light should increase with the angle of incidence, and at different rates in different bodies is little in accordance with the principles of the undulatory theory: the case of total reflection seems also

incapable of any satisfactory solution on these grounds; that the new vibrations should be propagated both ways till the incidence becomes a certain quantity, and then that they should all cease entirely in the new medium and be excited with a much greater intensity in the first, presents the appearance of a paradox which cannot put on the garb of truth.

17. The seventh fact, viz. that of the dispersion of light, or its unequal refrangibility, is allowed to be inexplicable, and to present a difficulty which has not been removed, and probably never can be surmounted; attempts however are making to clear up this very important point, by involving in the calculation some functions of the displacements of the particles of the vibrating ether, which till now have been neglected: how far this may affect the explanations of other phænomena, or accord with the facts themselves to be explained, I cannot tell; but altogether the theory is remarkable for a multitude of twistings.

Besides all this, the results in general depend on the assumption that the elasticity of the ether, and consequently the velocity of light is less in bodies which are of a greater refractive density. This is said to be probable; but no good reason is assigned to shew its probability: I think it is improbable, exceedingly improbable, if not impossible. The particles of bodies have no action on the ether, or they act on it either by attraction or repulsion. Now if they have no action on it, the pores of bodies will be occupied by the ether in the same state as in a vacuum, the elasticity will be unaffected, and there can be no reflection or refraction. If the actions between the particles of bodies and those of the ether were only attractive or repulsive, no diminution of elasticity could arise on that account; indeed if any alteration could take place from either of these circumstances, we should expect an increase of elasticity in the denser body. Hence this supposed diminution of elasticity, and consequently of velocity in the denser medium, if admitted at all, must be admitted gratuitously, since no good physical cause can be assigned for such a change.

18. In explaining reflection and refraction, it has been assumed, that in passing from a rare to a dense medium, we must consider small elastic bodies as striking larger, and from a dense to a rarer medium, large particles must be considered as striking smaller ones: but this applies only by a far-fetched analogy; we have, in this instance, not merely simple lines of elastic bodies, we must take into the account the essential property of fluidity.

In closing this part of the subject, we may just notice, that even after the enormous admission, which allows space to be uniformly occupied by an universal fluid, the cause seems inadequate to the effect. We have no reason to think that the light emitted from the several parts or points of the sun's surface is more intense than that of a lamp or common candle, and even if the elasticity of the ether were perfect, the expanding waves so feebly excited, would, as we should naturally conclude, before reaching

the earth, be so exhausted by expansion, that we might consider their action even on the delicate organ of the eye, as perfectly insensible; at any rate, it does not seem probable that the immensely distant fixed stars could exhibit their brilliancy: but the elasticity, according to the theory, must be imperfect; how then can we look for effects so great, from a cause comparatively so minute? It is not without good reason that Sir J. Herschel observes: "Certain admissions must be made at every step, as to the modes of mechanical action, where we are in total ignorance of the acting forces; and we are called on when reasoning fails us, occasionally for an exercise of faith." *Treatise on Light*, art. 565. He adds, "The undulatory system especially is necessarily liable to considerable obscurities; as the doctrine of the propagation of motion through elastic media is one of the most abstruse and difficult branches of mathematical enquiry, and we are therefore perpetually driven to indirect and analogical reasoning, from the utter hopelessness of overcoming the mere mathematical difficulties inherent in the subject, when attacked directly."

If GDB, fig. 2, be considered as a wave propagated from S; then each point of it will propagate waves in all directions; but Sir J. Herschel has shewn, *Treatise on Light*, art. 628, 629, that, the direct rays only are efficient to illuminate any point, at s; because the secondary waves excited at a moderate distance from D nullify each other's effects by interference. Now the same arguments will shew that any small object illuminated by the whole of the sun's disk would be equally illuminated by a small portion of it, as suppose the ten thousandth part, because the waves propagated from the exterior regions, being in every imaginable phase, will counteract each other's effects, leaving only the direct light sensible. Similar observations might be made respecting waves of light thrown by refraction to a focus. These observations are by no means intended to oppose the principle of interference of light, that principle is founded in nature and fact, and is of extensive application; yet it is not that *every thing*, which it is made in support of the undulatory theory.

19. We proceed to explain the same fundamental facts on the simple principles of the new theory, as stated in the 7th and 8th articles above.

Referring to art. 9, 10, and 11, it will be manifest that an immense number of ethereal atoms attach themselves to the surfaces of the sphere of repulsion of each tenacious atom, forming on it an atmospherule, in which the centres of the ethereal atoms are retained within the sphere of each other's repulsion, in consequence of the superior force by which they are attached: now it is very manifest, that if the central atom were at once annihilated, these ethereal atoms, being freed from the retaining force, would be projected in all directions by their mutual repulsions; and, because of their very small masses, they would separate with very great velocities. The same thing will occur in every case of energetic chemical combination: for, in this case, two or more central tenacious atoms,

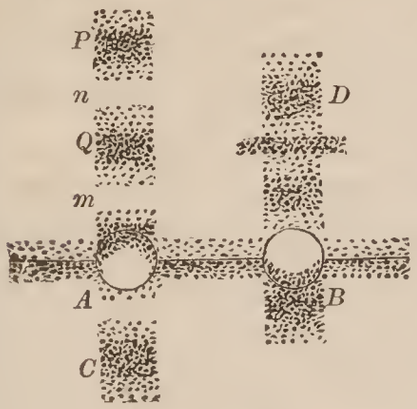
penetrate with rapidity each other's atmospherule, and become involved in one; hence plainly, much of this ethereal matter constituting the separate atmospherules will be released from the bond which held them so closely together: and thus we have an adequate cause for the extrication and propagation of light; and this cause is such as agrees with all the phænomena in which it is concerned, with every chemical as well as optical fact.

We may here remark, in a short digression, that this view of the subject affords a complete and satisfactory explanation of the doctrine of definite proportions in chemical combinations, and nothing can be imagined more fully to enter into all the peculiarities of that fundamental law in chemistry, and indeed in no other way can the important and interesting facts relating to that doctrine be explained.

20. During the passage of light, as thus stated, through free space, it is manifest, from dynamical principles, that its motion will be uniform and in a straight line: in traversing a medium of ethereal matter, its motion will also be rectilinear, retaining its original velocity, because every retardation of its sphere of repulsion will experience an equal acceleration; but pulses and undulations will necessarily be produced in such medium, through which it moves. Let *A*, fig. 3, represent an ethereal atom moving in the line, *PC*; the sphere of repulsion of the atom being denoted by the small circle at *A*, the centre being at the middle: it is manifest, that this sphere of repulsion will condense the ethereal matter in its path, and will therefore be retarded; but having passed the point of greatest condensation, it will be equally accelerated, because the displaced ethereal atoms will return behind the centre of the moving atom with the same force as that by which they were displaced, on account of the perfect elasticity of the ethereal matter, arising from the mutual repulsion of its atoms; the points of greatest condensation, and consequently of greatest retardation, are represented at *P*, *Q*, &c., and those of greatest rarefaction and acceleration at *n*, *m*, &c. The atom at *A*, is represented as having just passed the point of greatest condensation, and that at B, as just beginning to encounter the greatest resistance; the ethereal matter of the medium is accelerating the motion of *A*, and retarding that of *B*. In traversing transparent media composed of tenacious atoms, since each of these atoms will retain an atmospherule of ethereal matter, and all the pores and interstices will be filled with this matter, similar phænomena of condensation and rarefaction will occur: also the atoms of light, in passing the atmospherules, will suffer small deflections, which will be continually compensated in every part of its progress, when the medium is uniform in all directions: hence, on the whole, the motion will still be uniform and rectilinear; and pulses in this case also will be excited in the path, as above described. Hence it follows that the velocity of light is the same in all media, and in every direction of its course, the accelerations and retardations counterbalancing each other, as is more fully shewn in the treatise on

Physical Optics: it may be here observed, that according to the Newtonian theory the velocity of light is greater, and according to the Huygenian theory it is in the same degree less, in dense than in rare media.

Fig. 3.



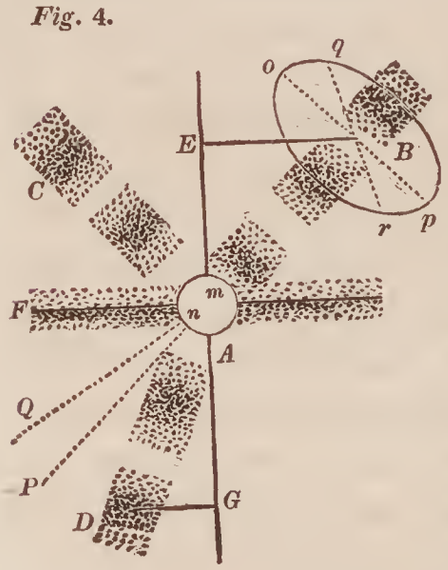
21. Since the absolute force of an ethereal atom is very small, and its velocity in the state of light is very great, and that the ethereal matter of the medium will be urged within its sphere of repulsion near the centre, both before and behind, it is manifest that the pulses will be extremely short; but that still they will be different for the different sorts of light, since their lengths will be greater as the absolute force of the moving atom is greater, and as the sphere of its repulsion is less; and thus we are furnished with a natural and easy view of the Newtonian fits, which correspond with the waves in the undulatory theory. The length of the pulse is the distance between two similar points, in consecutive pulses. The pulse thus excited, which may be called the direct pulse, will produce others, by the displacement of the ether: particularly a pulse will arise perpendicular to the path, as at *D*, fig. 3, and this after having acquired any particular azimuth, considering *D B* as a vertical line, will retain that azimuth while the medium remains uniform; since all its deviations will, in this case, be compensated: this may be called the transverse pulse; another, or complementary pulse of small amount, will result at right angles to both the former; all other displacements in the ethereal matter will be too slight to require notice.

The angles, edges, and surfaces of bodies contain an accumulation of ethereal matter, as is shown in the New Theory, and in this respect there will be a difference according to the nature of the body, so that generally, the accumulation of ethereal matter will be more dense at the one surface than at the other in two contiguous media: thus in the figure the ethereal matter at the surface of the lower body is represented as more dense than that at the surface of the upper medium. Now when the atom of light encounters this common surface, as at *A* or *B*, it will be in a state to be more easily reflected, or transmitted, according to its phase at that moment, which is precisely agreeable to Newton's conclusions: also the less the difference in the accumulations of ethereal matter on the two surfaces, the less will the state of the light be changed, the deviations at one surface being more nearly compensated at the other, so that the light will enter the new medium in greater quantity, and with less deviation; all of which answers perfectly to what occurs in nature. The velocity in every case will remain the same, since every deviation is a sort of reflection, and the motion, destroyed in any direction, is always regenerated in the returning direction. Besides, a small degree of attention will shew that the direct pulses must be longer in a medium where the ethereal matter is less con-

densed; so that the lengths of the pulses will necessarily be inversely as the refractive densities, which also perfectly accords with observation and fact. Hence it follows that when rays of light meet a new medium perpendicularly, as in fig. 3, some part of them, generally less than half, because the accumulation of ethereal matter is not excessive, will be reflected; and the azimuth of the transverse pulse, as at *D*, will not at all, in this case, affect the circumstances conducive to reflection or transmission.

22. Let the attention be now directed to the progress of oblique rays, as *B A*, fig. 4, draw *B E* parallel, and *E A* perpendicular to the surface *F A*, which suppose horizontal; in the case of reflection it is seen, that as the vertical motion diminishes while the obliquity increases, so the quantity of light reflected will on this account continually increase, with the angle of incidence, which actual experiment confirms. Whether the light is reflected or transmitted, it is manifest that it will continue in the plane of incidence, since there is nothing to deflect it from that plane. When the light is reflected the horizontal motion is destroyed by the reaction of the condensed ethereal atoms at the common surface, but this will be exactly restored by the equal action on the other side of the perpendicular, because the ray returns in the same medium, and consequently meets the same disposition of ethereal matter; hence the angles of incidence and reflection will be equal.

Fig. 4.



23. Next suppose the atom at the new surface in such a phase of its pulse that it is transmitted, and let the lower medium be the denser, as represented in fig. 4; now when transiting the common surface at *A*, it is evident that the resistance is greater at *n* than at *m*, hence by the reaction of the ethereal matter at *n*, a deflection, or kind of reflection, will take place from the direction *B A P*, to some new direction *A D*, which will depend on the difference of resistance at *m* and *n*, when the atom *A*, and the angle of incidence are given; and also on the horizontal velocity *B E*, when the angle of incidence is variable: hence when the media and the atom *A* are given, the resistance at *n* will depend on the horizontal velocity alone, and will be proportional to it; for whether the deflection be effected at one pulse, or at several, the resistance will depend equally on the same cause for each, and the horizontal velocity will be changed, either at once or at successive intervals, by a quantity proportional to itself: but the absolute velocity remains unaltered, on account of the perfect elasticity of the ethereal matter: therefore taking *A D* equal to *A B*, and drawing the perpendiculars, *B E* and *D G*, to the vertical line; *BA* and *A D* will be described in equal times, but *B E* represents

the original, and DG the new horizontal motion, hence these are in a constant ratio; but they are the sines of incidence and refraction to the radius BA or AD; thus we have a complete and simple explanation, and proof of the law of refraction, and perhaps the first dynamical proof ever given independently of hypothetical principles: and thus the reader has before him a satisfactory solution of the 1st, 2nd, 3rd, 5th, 6th, and 8th facts stated in the twelfth article.

24. Since, according to these principles, the atoms of light differ, both in regard to their absolute force and to their spheres of repulsion, and that evidently an atom will be less refracted as its absolute force is greater, or as its sphere of repulsion is less; it follows, that different sorts of light will be refracted differently, accounting accurately for the prismatic dispersion of light, as in the seventh fact enumerated above, and perhaps this is the only physical explanation which can be given of this curious and important property of light.

The fourth fact will be a natural consequence of slight irregularities on the surface of the medium, and the pulses excited at the point of incidence by the atoms of the beam of light, which will produce, not only scattered radiations at that point, but also the absorption of many atoms which so meet the medium as to have their motions destroyed or altered, by communicating it to the atoms of the medium.

25. To explain the ninth fact, let the ray proceed from the denser to the rarer medium, as from DA to AB, fig. 4, hence the preceding reasoning will shew, that the angle EAB is always greater than DAG, and becomes a right angle, while this is acute, and at this point the refracted light, if it proceed at all, must pass along the surface of the medium, and at all greater angles of incidence, it must be reflected, and so that the angle of reflection shall be equal to the angle of incidence, and hence total reflection will be the result.

From what has been advanced, it is manifest that the less the difference between the density of the ethereal matter accumulated on the surfaces of the two media, where they are conjoined, as at FA, the less will be the refractive force, or difference of action at m and n, and consequently the deviation will be less, and will vanish when these are equal, answering to the second fact originally stated.

The foregoing considerations indicate, that bodies which absorb much light, communicate much heat; since according to this theory caloric is the same as light, except that, as caloric, the atoms are moving with a less velocity, which here is communicated by the action of the light absorbed.

Having thus given the three explanations of the important and fundamental facts relating to light, as proposed, it now remains with the reader to judge and decide for himself respecting the merits of each, and to satisfy himself on the question, which is the most simple, natural, and easy to understand, and most in accordance with dynamical principles.

In conclusion let it be observed, that this theory may be applied with equal ease to the explanation of the important, complicated, and brilliant phænomena of thin and thick plates, diffraction, double refraction, and polarisation of light, plain and circular, with the phænomena of coloured rings by polarised light, &c. as may be seen in the Physical Treatise of Optics, to which reference has been made.

Probably the following observations, relative to the polarisation of light may be acceptable to the reader; let $B\,A$, fig. 4, be the direction of the ray, $o\,r\,p\,q$ a plane at right angles to it; the transverse pulse will be in this plane: first let it be in the direction $o\,p$, in the plane of incidence; at the moment when B arrives at the surface $A\,F$, if the transverse pulses be moving in the direction $o\,p$, that is towards the surface, it will favour reflection by pressing on the ethereal matter at the common surface; but if it be returning in the direction $p\,o$, it will favour transmission, by taking off a portion of the pressure, and since it will be as often in one of these positions as in the other, the differences in the quantity of light reflected, or transmitted, will not be altered in consequence of this pulse.

Again, let the transverse pulse be perpendicular to $o\,p$, that is at right angles to the plane of incidence, and consequently parallel to the surface of the new medium: when the atom of light B arrives at A, the accumulated ethereal matter at the surface will be affected evidently by this pulse, in the same manner, whether it is going or returning; and in both cases it is throwing ethereal matter over the centre of the moving atom, and therefore always favours transmission to which independently it has a tendency; hence in this position of the pulse, it will be always transmitted, and the transverse pulse will continue in the same direction, since there is nothing to produce a change in this respect. It will be seen from what is advanced, that at any azimuth between the two former, more light will be transmitted, and consequently less reflected, as the transverse pulse is nearer to the last-mentioned position.

Besides this, when the transverse pulse is neither in the plane of incidence, nor at right angles to it, the resistance at the surface will bring it nearer to one or other of these planes, according as it is reflected or transmitted, which is easy to prove, so that the reflected light will have the several transverse pulses nearer to a coincidence with the plane of reflection, and that of the transmitted light nearer to a perpendicular to that plane; and this circumstance unfolds at once the hitherto-mysterious cause of polarisation in all its peculiarities.

Sir J. Herschel observes, that the phænomena of diffraction "are completely accountable for on the undulatory doctrine, and form, in fact, its strongest points." Now the explanation is derived from the doctrine of the interference of light; the fringes being supposed to be produced by the interference of the direct light with other light passing near the body, and bent from its direct course: the great difference in the quantity of

light passing in these directions militates against the explanation; but allowing it to be admissible, the same advantages may be derived from the theory above proposed; since similar interferences will occur by means of the pulses excited in the ethereal matter by the moving atoms of light, and similar calculations may be applied; nor is there any phænomenon explicable either by the Newtonian or the undulatory theory, but such as can without difficulty or intricacy, be well explained on the New Theory, which also explains many facts not to be accounted for by the one or the other of "the rival theories," if indeed the term rival may still be applied, as I understand that M. Biot, one of the most able and strenuous advocates of Newton, has changed his views in favour of the undulatory theory.

In comparing these explanations, the reader will bear in mind, that the third depends, solely and entirely, on principles philosophically derived from physical phænomena, which have no immediate relation to optics, and obtained without any reference to the operations of light.

ON CERTAIN OBJECTIONS RECENTLY ADDUCED

AGAINST THE HYPOTHESIS WHICH SUPPOSES

THE CENTRAL MASS OF THE GLOBE TO BE IN A STATE OF IGNEOUS FUSION.

Mr. Editor,

In a recent number of the Edinburgh Philosophical Journal, edited by Professor Jameson, April, 1835, my attention was attracted by the following passages in an article on "Ampere's Theory of the Globe," containing objections alleged against the hypothesis, entertained by many geologists, which supposes the central mass of the globe to be in a state of igneous fusion, and drawn from the consideration of the perturbations to which it is said the crust of the globe must on this hypothesis be exposed, from the swell of tidal waves which it is urged the influence of the moon and sun must excite, in the supposed fluid mass.

"Those who maintain, that the internal nucleus of the globe is in a liquid state, do not appear to have reflected upon the action which the moon would exercise on this enormous fluid mass: an action, from which would result tides analogous to those of our seas, but infinitely more terrible in their effects, both on account of the extent and the density of the liquid. It is difficult to conceive, how the casing of the earth could offer resistance to the continued shocks of a sort of hydraulic lever fourteen hundred leagues in length."*

* "Mr. Lyell, in the last edition of his Principles of Geology, vol. ii. p. 284, has combated the doctrine of a central heat upon principles similar to these: 'granting for a moment,' says he, 'that the tides in this internal matter can have become so feeble, as to be incapable of lifting up every six hours the fissured shell of the earth, may we not ask, whether during eruptions, *jets of lava ought not be thrown out** from the craters of volcanoes when the tides arise, and whether the same phænomenon would not be more conspicuous in Stromboli, where there is always lava boiling in the crater? Ought not the fluid, if connected with the interior ocean, to disappear entirely on the ebbing of its tides?'"

* The italics are our own.

On reading these passages, it certainly appeared to me that the perturbations thus indicated, as probable consequences involved in the hypothesis in question, were very materially exaggerated, especially in Mr. Lyell's view, and were in a great degree inconsistent with the very conditions which that hypothesis necessarily assumes.

I by no means wish to pledge myself to a dogged defence of this particular hypothesis ; but still it is surely quite as unphilosophical to argue against an hypothesis without giving it the advantage of a fair examination of its own essential conditions, as it is to maintain such an hypothesis as firmly established, while our evidence must probably always remain so very imperfect and inadequate. I shall shortly therefore invite the attention of your readers to the general conditions of the hypothesis in question, and the conclusions which appear to be logically deducible from these conditions. The temperature of the earth has been ascertained from very numerous and independent observations in deep pits in different countries, to increase as we descend at the rate of about 1° Fahrenheit for every fifty feet, or about 100° Fahrenheit per mile. Now if we suppose that the increase proceeds in any thing like the direct proportion of the depth, rocks of the constitution of basalt, (which melts at forty Wedgwood)* would become fluid at about thirty-three miles, and the more refractory metals, such as iron, nickel, and platina, at about one hundred and fourteen miles of depth.

Now, on these suppositions, it should seem to follow as the fundamental condition of this hypothesis, that it would represent the crust of the earth as quite solid to the depth of between twenty and thirty miles ; beneath which we cannot conceive that the interior mass would at once become perfectly fluid ; the more probable conclusion must be (on the grounds of the hypothesis) that the first or highest portions would be only rendered to a slight degree viscid, and this viscidity would increase for nearly ninety miles more, before, from the fusion of the more refractory materials, any thing like a perfectly fluid mass would result. Now I need not dwell on the great resistance which such a consistency would oppose to any violent tidal waves, nor how fatal it seems to Mr. Lyell's notion of *jets of lava;* the utmost effect indeed which could be produced in the volcanic vents by the ebb and flow of such subterranean tides would be a tranquil elevation of a few feet, unless their effect were aggravated by a configuration of the interior, which seems inconsistent with the views concerning its structure, naturally suggested by the hypothesis. On communicating these views to a scientific friend, far more competent than myself to arrive at just conclusions on a subject involving dynamical principles, I received the following

* I here follow Morreau's Comparative Table of the Degrees of Wedgwood's Pyrometer, as related to Fahrenheit's Thermometer.

answer, which I think may prove both interesting and amusing to your geological readers, and which I therefore enclose.

I remain, your old correspondent,
W. D. CONYBEARE.

"——— You desiderate information concerning the tides of the nether regions. As I cannot get any satisfactory ebb and flow in the Pacific, I am quite disposed to look for any thing of the kind which is to be found lower down. *Flectere si nequeo superos Acheronta movebo.* There are no tides at Otaheite, but I do not see why Phlegethon and Cocytus should not alternately boil and simmer, and produce, twice every infernal day, a *bore* as loud and fierce as the Bristol Channel itself. Nevertheless we must give the devil his due and no more, and not flood his "burning soil" with lava every morning and evening, in a manner contrary to law. Now as to the tides of the central incandescent fluid which the laws of nature will produce, I do not think they can be engineered so as to do the work which, it appears from your letter, Lyell wants to put upon them. You may take two hypotheses;—*first*, that the surface of the infernal ocean is not free, but that the fluid *fills* its cavities, being open only at certain orifices. In that case it will be as you say; the effect of the solilunar force will be a pressure equivalent to the weight of the tide which would be produced; that is, to a stratum, say, of six feet high of lava, and the effect of this will be to diminish by so much the downward pressure of the superincumbent rocks; that is, on your supposition, to diminish the effect of more than thirty miles of rock by six feet, in addition to which you have the cohesion of the rock on the conservative side. This could not do any serious mischief. On this supposition too, I conceive, there would be no jets, but only a rise and fall, very quiet, of the above-mentioned six feet in the open orifices; for the requisite transfer of fluid will be made by small and tranquil movements. But if the subterraneous ocean swill about in vaulted caverns, supporting themselves, you may have a tide-wave exaggerated by resistance, contraction, &c. as you denizens of the Severn well know, and thus you may have jets and squirts. This however is a hypothesis which does not appear to be contemplated by those who make a universal fusion of the central part of the globe. You will find that Cordier makes his crust of the earth *bend* to the oscillations of this central fluid, though I suppose only now and then, in case of volcanic and terramotive operations. 'Nous sommes arrivés a connaitre,' he says, 'que cette ecorce jouit vraisemblablement d'une certaine flexibilité.'

I conceive too that even allowing the central fluidity, the viscous nature of the substance, at least of the superficial parts of it, will neutralize all tide waves; this comes to nearly the same thing as thickening the crust, not quite; for, by the viscosity, the force which resists the inequality of

pressure is supplied, not by a single surface, but by a semifluid coat of, it may be, fifty miles thick. This will protect the bottoms of our continents,

> 'Like feather-bed between a wall,
> And heavy brunt of cannon ball;'

so I think we may sleep quiet in our beds, without fearing to have them turned topsy-turvy by a jet of lava at new or full moon."

ON THE ANATOMY AND PHYSIOLOGY OF THE ORGANS OF THE SENSES.

We propose, in the present and a few succeeding papers in this journal, to consider the structure and functions of the organs of the senses, in man and other animals; and this we shall endeavour to do as concisely as is consistent with clearness, and in as popular a manner as the introduction of much unavoidable detail will admit of.

But because the mere organ of a sense is by itself incapable of transmitting its impressions to the mind, and because the assistance which the senses derive from each other is in like manner dependent upon a distinct medium, it will be necessary, to render their investigation satisfactory, to include within it that of the medium by which they are connected, and along which their impressions are conveyed to the sensorium, and the mandates of the sensorium in turn reconveyed to the muscles by which the requisite movements are performed—the nervous system.

We are to consider then, the organs of the senses and the nervous system, that is to say, the means by which we take cognizance of what is going on in the world around us, and by the aid of which we are enabled to turn to our present and future account the knowledge thus acquired.

Inasmuch as it is only of late years that the method of reasoning by strict induction has been generally applied in anatomical and physiological science, it is only lately that the exceedingly minute details of the animal frame have been thought worthy of investigation by anatomists in general; and although the minutest examination of the organs of the senses has as yet thrown very little light upon the composition of that part which actually receives impressions, yet the investigation has been much more successful when directed upon the superadded parts of some organs, as for instance, the eye; and the general conclusions arrived at have enlivened the dry anatomical detail, and caused facts, formerly isolated and uninteresting, to become parts of a system, arranged like the stones of a finished edifice, each concurring to the general support and stability of the whole.

The value of the inductions to which a minute investigation of the organs of the senses has led, has not however enriched anatomical and physiological science so much as might have been expected; for the organ of only one of the senses, that of vision, is at all well understood, and that because the laws of refraction, dispersion, &c. and other properties of light having

been by other means discovered, served to explain the composition of the eye; and this is the reason why the eye is, and the ear is not, understood: no question at all but that the parts composing the ear are as carefully arranged, as necessary, and as subservient to hearing as those of the eye are to vision, it would be contrary to analogy to conclude otherwise, but the science of optics is comparatively well understood, that of acoustics is not.

But the eye and the ear rest together upon a different footing, and must be considered under a very different point of view from the organs of the other three senses.

In those two there is superimposed upon the mere expanded nerve,—the part essential to the whole five—an apparatus for the collection and concentration of the rays of light and waves of sound, which is as purely mechanical as the object glass of an achromatic telescope, or a hearing trumpet; and capable, when injured, of being in some measure superseded by artificial means. This apparatus then, this mechanism, these parts accessory, we understand and explain, but we do not at all understand the manner in which the light, when concentrated, acts on the retina, any more than we do how the odoriferous particles act upon the nerve of olfaction, and the parts, the use of which we comprehend, are no more than parts of the organ which might have been extraneous. It is not therefore that we have advanced further towards the complete understanding of the mode in which any one sense more than another is impressed, but that we have explained the uses of certain superadded parts in the one case, while there are no superadded parts, or scarcely any, in the other.

With the exception, then, of the conclusions respecting the mechanism of the eye, and a very few points which have been established concerning the ear, the facts observed with regard to the organs of the senses, have not been made as yet subservient to anatomical or physiological science, nor indeed to any conclusion save the general indication of design.

Towards the classification of animals, the grand result of induction as applied to Zoology, the consideration of the senses has contributed little or nothing: the vital organs, those the uninterrupted action of which is essential to life, have been taken as parts upon the complexity of which the place of an animal in the great scale of animal existences is to depend, and justly so. But it is found, that the development of the vital does not imply a corresponding development in the sensorial functions; so that the class insects, with whose active habits and quick perceptions every one is familiar, are actually inferior to the mollusca; or, in other words, the ant and the bee, about whose—we might almost say moral—history volumes have been written, are absolutely inferior in the development of their vital organs to the oyster or slug. In truth the development of the organs of the senses seems to have reference solely to the habits and circumstances of the animal's life; and although the adaptations consequent thereon are extremely striking, they afford no just ground for a general classification.

Matter, or that of which the world upon which we are placed is composed, is known to us only by the existence of certain properties belonging to it; and the means, by which we are enabled to appreciate those properties, are called the senses, or rather we should say the physical senses, in contradistinction from our sense of right and wrong, &c. called our moral senses.

But the actual scope of the senses has been prodigiously over estimated, and a great variety of perceptions, which are conclusions due to reason, have been attributed to the senses. The objects made known to us directly by our senses are few; their impressions are rather data, from which we derive certain inferences, but we forget or neglect the chain of reasoning, and attribute the inference directly to an impression. Thus the existences of light and heat are spoken of usually as made known to us by the evidence of our senses, whereas they only take cognizance of certain effects of colour or temperature upon different bodies, which are compared together by our reason, which thence draws the inference that light and heat exist abstractedly considered, and distinct from the bodies on which their effects have been observed, although it is evident no organ of sense has ever been thus directly impressed by them. Such knowledge is the result of a comparison; that is to say, it is a conclusion of the reason, drawn from data supplied by the memory, and by no means an original perception of sense.

In the higher animals the senses are five in number, tact, taste, smell, hearing, and sight; to which have been added, the sensations of heat and cold, that attendant upon the action of a voluntary muscle, and perhaps some others equally specific with any of the former, although their seat is not so well understood. Of these senses, a greater or less number are enjoyed by all organised bodies possessed of animal life, and possibly by a very few others, though in very different degrees of perfection.

The relative importance of the senses in the œconomy of the higher animals, will be best seen if we enumerate the other functions with them. These are, the mechanical, chemical, vital, sensorial, and reproductive.*

Under the first are comprehended the mechanism and leverage of the joints, the various methods of locomotion and prehension, the adaptation of the skeleton to its ends, the production and modulation of the voice, and a variety of other provisions which it is unnecessary to enumerate.

Under the second, the chemical, are the changes undergone by the atmosphere during the process of respiration.

Under the vital, we have the various processes subservient to nutrition; as digestion, chylification, secretion, nervous power, &c. a series of effects to be referred neither to mechanical nor chemical agency, and called, from their occurrence only in the living body, vital. The fourth set of functions

* Roget.

are those of sensation. The fifth, the reproductive, have been made to comprehend organic development and decay.

The sensorial may then be regarded as superadded upon the other functions, and not at all times necessary to the existence of life.

Upon the importance of comparative anatomy, that is to say, of *comparing* the structure of the lower animals with that of the human frame, it is unnecessary to insist. The organisation of man bears so many relations, and presents so many analogies, to that of other animals, that the advantages of a comparison must be obvious.

And this is particularly true with regard to the senses. Of the vital organs, those possessed by man are for the most part superior to all others, but his sensorial are not. Man is inferior in keenness of vision to the bird of prey, in acuteness of scent and hearing to the dog, in tact to the bat; so that, although there does not appear to be any animal possessing all the senses in a superior degree of perfection to man, yet as many of them are superior to him upon a single sense, the parts of their organs are larger and more fully developed, and are therefore better fitted for the purposes of anatomical investigation.

Again, as the sensorial organs of the animal are fitted to the medium in which he lives, or the circumstances under which they are employed; as in the fish to water, in the bird to air, or in the night-prowling animals to a small degree of light; we might in each of such cases expect to find some part peculiarly prominent, and hence be enabled to draw some conclusion as to its use.

Thus, in the inner angle of the human eye we find a small eminence and fold of membrane, upon the use of which we might in vain speculate; but we examine the eyes of the inferior animals, and there we find this fold fully developed as a third eyelid; a membrane, by the intervention of which, the eagle is enabled to look at the sun.

The consideration of the organs of the senses derives also great interest from the close connexion subsisting between their functions and those of the sensorium, in the reciprocating actions of either; and the prospect thence opened, of being enabled to comprehend something of a class of phænomena hitherto regarded as inscrutable. At any rate, the connexion between the organs of the senses and the intellectual functions is evidently extremely close; so that it is difficult thoroughly to investigate the one, without being led to bestow a good deal of attention upon the other.

These organs are undoubtedly the parts of the material frame most conversant with its immaterial principle, they are the channels through which much of our knowledge flows; music, as has been observed, has no charms for the deaf, nor has painting for the blind; and all the splendid imagery, borrowed by the poet from the world without, would lose its magic power, and might as well be presented to a marble statue as to man, were it not for his senses.

Whenever an organ of sense is of size sufficient to admit of its examination, which it is in all the higher and in many of the lower tribes of animals, a number of medullary or nervous filaments may be detected in its structure; the attenuated extremities of which are expanded upon, or rather, form the sentient surface of the organ, and are finally collected into a single trunk or nerve, by which the connexion between the organ and the sensorium, and by its intervention, between one organ and another, is established and preserved.

Among the provisions, of which the animal œconomy is full, there is none more striking than that by which the different nerves are adapted to receive and convey different classes of impressions. Thus the optic nerve, that of vision, appreciates the rays of light, but is insensible to a grosser injury, and feels no pain when wounded. The nerves of the skin, liable to a thousand accidents by heat, injuries mechanical and chemical, are alive to such impressions; but light and sound can never injure the skin, and therefore their impressions, felt so acutely by the eye and ear, are in no degree felt by the skin. The tendons and ligaments, when divided beneath the knife of the surgeon, give no pain; but place these ligaments on the stretch, an injury unfelt for obvious reasons by the flexible integument, and a sensation of pain will be produced, calling upon the sufferer to attempt the relief of the part.

It is found moreover that these nerves are so organised, as to refer all their impressions, at whatever part of their course received, to the extremity, that is to the part of the body for the supply of which they were provided; so that if the nerve supplying the inside of the hand be struck, as it often is, where it passes over the elbow, a tingling sensation is felt, referable, not expressly, nor in any great degree to the elbow, but to the fingers below. If the nerve injured supply an organ of sense, the impression produced is not that of pain, but that which the organ is calculated to receive, so that if the optic nerve be pressed upon as it enters the orbit, a sensation of a flash of light is produced.

The minuteness of the ultimate filaments in which the nerves by which the integument is supplied, terminate, is very considerable; every part of the surface has its particular nerve, and as every part of the body is liable to aggression, every nerve must be competent to produce a distinct impression upon the sensorium, which must thus present an epitome of the superficies of the body, as the acorn is said to contain all the ramifications of the future oak.

When an organ of sense has received an *impression*, that impression is conveyed along the nerve to the sensorium, producing there a physical change, by which it is presented to the mind as a *sensation*, and its recognition, its apprehension by the mind, constitutes a *perception*. These two faculties being alone of comparatively little value, we find a third power added, by means of which certain measures are determined by the mind, and this is called *volition*.

Between the receipt of an impression by a sensorial organ, and the measures practised in consequence of it by a voluntary muscle, so short a period elapses, that it appears to be instantaneous; it is worth while to analyse this process, and to see what steps must occur before the motion can be given.

An ingenious and able physiologist, Dr. Roget, has divided these steps into twelve. Let us suppose the case of a fly settling upon the eyelid, and to be got rid of by a wink or muscular contraction of the part.

1. His figure, falling upon the cornea, impinges upon the retina, or expanded nerve below.

2. An *impression* or picture is formed upon that organ.

3. That impression, received by the optic nerve, is transmitted along the nerve as a vibration, to the brain.

4. There is a physical change produced thereby in the sensorium.

5. The change from matter to mind takes place, the physical impression being presented as a *sensation.*

6. The reception of the sensation by the mind, constitutes a *perception.*

7. At this stage the mind deliberates upon what course is to be adopted, which being guided in a great measure by experience, is called *association.*

8. The result of its deliberations is issued as volition.

9. The communication of which to the sensorium, involving a physical change, constitutes the ninth stage.

10. That change is propagated along the nerve of motion, and

11. The muscle encircling the orbit is incited to contract:

12. This contraction producing the desired effect, completes the series of changes, and whisks off the fly, all unconscious of the elaborate train which he has put in motion, although there is reason for concluding that his own organisation admits of one precisely similar.

The velocity with which these physico-psychological changes occur is no doubt very striking if it be compared with purely physical motions, but it ceases to be so if we compare it with the ordinary velocity of those of the mind: to the rapidity of these operations, that is of thought, that is to say to the vast number of ideas that may be clustered into a minute space of time, there does not appear to be any limit, since it is certain that the succession of ideas usually spread over a long period of waking time, may under certain conditions of the mind, as for instance during a dream, be exhibited in an instant.

The assistance, for the most part unacknowledged, derived by one sense form the impressions received by another, is very considerable; and these senses are not bestowed upon the infant in full perfection, that is to say, the want of the habits of comparing present perceptions with former ones presented by the memory, renders the actual perception of less value: and it is only when use has become to us a second nature, and the actual and past perceptions are compared, and the conclusion deduced without any

trouble or special attention of the mind, that we derive full benefit from our senses, and are enabled to arrive at those conclusions respecting the distance and relations of bodies, that seem to be intuitive, but which are the results of long and constant habit.

In the arrangement of the sensorial functions, it seems simplest and most philosophical to consider them as modifications of tact. The organ of tact consists of a series of minute nervous filaments, expanded over the whole surface of the body, and shielded by a delicate veil of integument, from any rude or injurious impression. Taste is evidently a species of touch, of a higher character indeed, since it takes cognizance of certain properties of bodies which tact cannot, and it is confined to a particular and limited portion of the animal. It does not supersede, but is superadded to the former sense, and requires the presentation of its object under somewhat different circumstances.

The next sense, that of smell, resembles in many respects that of taste; requiring only the presentation of its subjects in a gaseous, instead of an aqueous vehicle. This sense is however superior to the other two, inasmuch as by it the sphere of perception is more enlarged, since it takes cognizance of effluvia, which may proceed from bodies at a considerable distance.

The senses of hearing and vision are of a superior character, and more generally interesting, since they involve the cultivation of two well known physical sciences, acoustics and optics. Hearing is obviously only a refined species of touch, the sense being excited by the vibrations of the atmosphere upon the acoustic nerve.

The sense of sight is superior to all the rest, both in the number of the properties of a body, which it is able by cultivation to take notice of, and more especially on account of the distance at which its impressions may be received. And if the undulatory theory concerning the nature of light, that generally received, be correct, the function of vision must be considered just as much a modification of tact, as those of taste, smell, or hearing.

We have said that with the exception of the eye, the facts observed respecting the uses of the parts composing the organs of sense, have not been sufficiently well ascertained, to lead to any grand conclusions in anatomical or physiological science; that such will sooner or later take place, is no doubt very possible, but it is not in the present state of our knowledge very probable. But so far as the uses of any parts have been discovered, they have been ever in strict accordance with truths, derived from other sources. Thus, when Dolland invented the achromatic lens, he found that the chromatic difficulty had been already overcome in the eye; and when Mr. Wheatstone discovered that a change in the plane of the motion of a wave of sound weakens its intensity, the canals within the ear were found to be so disposed as to obviate such a change: and we cannot

observe such contrivances in the internal structure of an organ, any more than in the adaptation of a peculiar modification of organ to the habits of the animal to whom it belongs, without becoming aware that these same facts, from which, when collected, any truth of physical science is deduced, admit also of a deduction of precisely the same strength, concerning the wisdom and intelligence of their Contriver. These conclusions, as Lord Brougham has clearly shewn, rest upon one and the same series of facts, and are deduced by one and the same process of reasoning; and not only cannot we, with any degree of fairness, retain the physical and reject the theological induction, but he who demonstrates the one may be fairly charged with a sort of anti-theistical partiality, if he wilfully obscures the other.

ON THE STRUCTURE AND FUNCTIONS OF THE ORGANS OF RESPIRATION,

IN THE ANIMAL AND VEGETABLE KINGDOMS.

The tendency to change is one of the most constant and striking characteristics, by which organised substances may be distinguished from inert matter. It is especially manifested in the *living* body, where it is applied to the maintenance of the system, under the controul of certain laws, which, from our complete ignorance of their nature, we can only characterise as *vital;* but we also observe the same tendency in the dead state of organised matter, causing the spontaneous decomposition of complex proximate principles into their ultimate elements or simple combinations of them. In the latter instance, the changes which take place are under the direct and evident action of the laws of chemical affinity; but the nature of those which occur in the living body is by no means so well understood; and although modern researches in Chemistry* have done much to prove that the laws of affinity, which govern inert matter, are also active in the organised body, yet we are constrained to admit the existence of a governing power, by which these laws are brought into exercise, and their extraordinary results controuled. And since on the existence of this power depends the continuance of the activity of the system, whether in plants or animals, its capability of maintaining its normal condition amidst a great variety of external circumstances, and its preservation from spontaneous decomposition, it is usually termed the *vital principle.*

* "Chemistry," says Dr. Roget, "notwithstanding the proud rank it justly holds among the physical sciences, and the noble discoveries with which it has enriched the arts; notwithstanding it has unveiled to us many of the secret operations of nature, and placed in our hands some of her most powerful instruments for acting on matter; and notwithstanding it is armed with full powers to destroy—cannot, in any one organic product, rejoin that which has been once dissevered."—*Bridgewater Treatise on Physiology*, vol. ii. p. 5.

If we submit to analysis the series of changes which constitute the phænomena of life, we shall find that they may be arranged under certain classes, to which we give the name of *functions:* some of these, as digestion, circulation, respiration, &c. are essential to the preservation of all organic systems, whether in the animal or vegetable kingdoms, and are hence called functions of *organic* life; whilst others, as sensation and locomotion, are confined to animals, and are termed functions of *animal* life; and a third class, which exists in all organised bodies, has for its object the continuance of the species. In the lowest orders of being, we find these functions very much blended together, and several of them apparently performed by one simple apparatus; but in proportion as we rise in the scale, we perceive that they are specialized, or separated from each other, and that a complicated set of organs is appropriated to each of them. They all appear to be more or less under the dominion of the common laws of attraction and affinity; but whether the extraordinary effects, which we may admire and investigate, but which we cannot imitate, are owing to a modification of these laws by vital power, or only to the peculiar manner in which they are brought into action, is a question with regard to which physiologists have as yet scarcely a right to give a decided answer. Probably, however, the latter is the correct mode of viewing the subject; and as the function of respiration is one, which, from its comparative simplicity, is pretty well understood, we have selected it as an illustration of these principles: it may be hoped that the time is not far distant, when our increased acquaintance with organic chemistry may enable us to submit other functions, such as those of digestion and secretion, to a similar analysis.

All living bodies, both animals and vegetables, are composed of solid and liquid constituents, the former taking their origin from the latter, and being constantly maintained by them; they are in intimate connexion with each other, and the continuance of life depends on their reciprocal action. In the higher forms of organic life, we discover a special apparatus for transmitting throughout the body the nutritive fluid, elaborated by the digestive organs; but as we descend in the scale, we find the vascular system in a less isolated form, and in some instances we lose all traces of distinct vessels for the circulation of fluid.

Respiration may be defined—the function by which the fluid, which has thus ramified through the body, is exposed to the action of atmospheric air, (either in a pure state, or as contained in water,) by which action a change in its chemical constituents takes place, its vital properties are renovated, and it is refitted for its essential duty, the nutrition of the system. It is not, however, to be supposed, that this fluid is ever brought into immediate contact with the air; a thin membrane intervenes in all instances; and the manner in which the process of aeration is effected, had long been a difficult question among both animal and vegetable physio-

logists. The discoveries of Dutrochet, however, on the endosmose and exosmose of fluids, and the parallel experiments of Dr. Stevens, Dr. Mitchell, and Mr. Graham, on the mutual penetration of the gases, and their transmission through membranes, have dissipated the obscurity which previously enveloped the subject, by showing that the process is entirely explicable on principles which we can readily comprehend.

All gases, of different densities, which are not disposed to unite chemically with one another, have a strong tendency to mutual admixture. Thus, if a vessel be partly filled with hydrogen, and partly with carbonic acid, the latter, which is twenty-two times heavier than the former, will not remain at the bottom, but the two gases will be found in a short time to have uniformly and equably mixed: and it is on this principle, that the constitution of the atmosphere is found to be every where the same, although the gases which compose it are of very different specific gravities. So strong is the tendency to admixture, that it will take place when a membrane or other porous medium is interposed between the gases; as, for instance, when a bladder of hydrogen is placed in an atmosphere of carbonic acid: a certain quantity of hydrogen will pass out of the bladder, and at the same time carbonic acid will enter; but the relative quantities of the two will vary according to several circumstances, of which the comparative densities of the gases, and the facility with which the membrane is permeated by each, are the principal. When plaster of Paris is employed as the medium of diffusion, the exchange will take place under the sole influence of the former: and a general law has been ascertained, which applies to all instances; that *the replacing or mutual diffusion of volumes of different gases varies inversely as the square roots of their densities.* Thus, if a tube, closed at one end with a plug of plaster of Paris, be filled with hydrogen, the gas will soon be entirely removed, and will be replaced by something less than one fourth of its bulk of atmospheric air, the density of hydrogen being about $\frac{1}{14}$ that of the atmosphere.

In the same mannner, if a fluid be charged with any gas which it will absorb, (as, for example, water with carbonic acid,) it will speedily part with it when exposed to the attracting influence of another gas, such as atmospheric air; and the more different the densities of the two gases, the more rapidly, and with more force, will this effect take place. As in the former case, this attraction will go on, with little interruption, through a porous membrane; and part of the exterior gas will be absorbed by the fluid, in place of that which has been removed.

These simple facts will be found a key to the explanation of the chemical changes which take place both in the circulating fluid and the respired air.

We do not yet know enough of the physiological anatomy of vegetables, to be able to define with certainty the uses of each different part of the system; and indeed there is often much difficulty in specifying the exact

effects produced by the whole. In the lowest classes of plants, we find a very simple organisation, which is capable of effecting all that is necessary for the maintenance of the individual and the continuance of the species. In the algæ and fungi, for instance, the structure is entirely cellular; no rudiments of vessels or traces of a general circulation are found in them; and although in some of the algæ there seems a tendency in particular parts to expand into leaves or leaf-like members, it cannot be said that there is any portion specially adapted for the exposure of the fluids of the plant to the influence of the air, the act of respiration taking place equally throughout the whole surface. In mosses we find the first indications of a higher form of organisation; for in these plants there are distinct leafy expansions; and in some species of liverwort *(marchantia polymorpha)*, *stomata*, or minute openings in the cuticle specially formed for the passage of air, have been observed by Mirbel and others. We also find amongst mosses, the rudiments of tubular vessels, to which the elongated cells of the *chara* form a beautiful transition; so that in the higher forms of these plants we may trace an approach to a more elevated type, in the specialization of the respiratory and circulating apparatus. In the ferns there is an extensive development of true leaves, plentifully furnished with stomata; the tubular apparatus for the circulation of the fluids is more complete, and we find the rudiments of spiral vessels or *tracheæ*, which in their perfect state are confined to flowering plants. In endogens and exogens, the organs adapted for the aeration of the sap are arrived at their highest degree of perfection. A regular circulation of that fluid takes place, by which every part of it is brought into communication with the air, through the medium of the thin cuticle of the leaf, beneath which it ramifies; and there is reason to believe that the stomata have a tolerably direct communication with the spiral vessels which are found in the midst of the stem, and which appear, from the quantity of oxygen they contain, to have an important relation with the function of respiration. It will hereafter be seen that the cuticle of the *green* parts of plants is to be considered as a digestive, as well as a respiratory surface.

In the animal kingdom we find respiration exerting a more evident, though perhaps not in reality a more powerful, influence over the system than in vegetables. The necessity for air is more urgent than the demand for food; many animals being capable of subsisting a considerable time without nourishment, but all speedily perishing when deprived of air; and a very remarkable correspondence may be observed between the activity of this function in any individual, and its general vital energy, which is especially manifested by the development of its organs of locomotion, and the degree of heat which it is capable of maintaining. In illustration of this fact, we need only refer to the comparative structure of the respiratory organs in the active and rapacious eagle, and the timid and indolent tortoise. In making such comparisons, we must bear in mind that the extent

of respiration does not depend on the comparative size of the organs, but on the extent of surface by which the blood is exposed to the action of the air; so that the minutely subdivided cellular lungs of a rabbit present greater opportunity for the aeration of the blood than the enormous sacs of a turtle ten times its size.

The organs appropriated to the performance of the function of respiration appear, at first sight, so very different, that a superficial observer would hardly trace any analogy between them. There would seem, for instance, but little resemblance between the gills of a fish, and the lungs of a quadruped; or between the beautiful tufts on the body of a sand-worm, and the air tubes of an insect: but a little consideration will show that all these forms are reducible, as in vegetables, to one simple element,—an extension of the external surface, specially modified by its permeability and its vascularity for the aeration of the blood. This extension usually takes place externally or internally, according as the animal inhabits a fluid or aeriform medium; the circulating fluid, in aquatic respiration, being generally propelled outwards to meet the air contained in the water; and in atmospheric respiration, the air entering the system to meet the fluid: the comparative densities of these media afford obvious reasons for this modification.

In the lowest classes of animals, which are all aquatic, we find the aeration of the fluid parts of the body performed by the external surface, and in some instances, apparently, by that internal prolongation of it which forms the digestive canal. The vibratile cilia, with which we see most infusorial animalcules, as well as the higher kinds of zoophytes, so largely provided, seem essentially connected with the function of respiration; and they may be traced upwards in the respiratory apparatus of the higher invertebrata, and even in some of the vertebrated animals. They do not however appear designed to afford an increase of surface for the distribution of capillary vessels; but, by their constant vibration, to renew the stratum of water in contact with the body, and thus to bring air as well as food within the animal's reach. "The simple organisation of these animals," says Dr. Grant, "requires no other respiratory system. Their "bodies are not yet covered with solid shells, or with dense impervious "scales, or with other hard materials which would exclude the general re- "spiratory influence of water, and necessitate the formation of gills or lungs; "but consist of the soft cellular tissue in which all higher organisations are "first developed. The few kinds which are furnished with a thin transparent "horny pellicle, have the power of extending the ciliated and prehensile "part of their body from beneath it; and thus of effecting all the required "respiration."

In sponges and other poriferous animals, which have a similar soft cellular covering, observation of their living state shows the rapidity with which the water is renewed over the surface of the body, and throughout

the whole of their internal canals, although we cannot detect the organisation by which this motion is performed. In their embryo state, however, when they exist as gemmules, we find them provided with cilia, in the same manner as the infusorial animalcules.

In passing upwards, through the classes of polypifera (true zoophytes) and acalepha (sea nettles), we find the function of respiration still performed according to the same type, until we arrive at the echinodermata, where we find tubes conveying water, ramifying throughout the interior of the body—the first appearance of an apparatus specially modified for the aeration of the circulating fluid.

In ascending through the series of articulated animals, from the simple parasitic worms, to the highly organised insects or crustacea, we find the respiratory apparatus assuming a more complicated form, and it is in this series that we first meet with animals inhabiting the air. The extension of the respiratory surface in air-breathing animals always takes place internally; though the converse, as we have just seen, does not always hold good with regard to the inhabitants of the water.

In the aquatic orders of the extensive class of annelides, we often find the aerating organs in the form of delicate plumose tufts, beautifully radiating from a centre, to form a fan-like expansion around the head, and frequently displaying the most splendid variety of colours. There are few sights more striking to the tropical naturalist, than the unexpected view of a bed of coral in shallow water, having its surface scattered with the brilliant tufts of the serpulæ which have formed their habitations in it; the glowing and variegated colours of which, when lighted up by the mid-day sun, and contrasted with the sombre hues of the surrounding rocks, present an appearance compared with which the most beautiful garden of carnations (which these animals much resemble in form) sinks into insignificance. In another portion of the class annelides, these ramified tufts are disposed at intervals along the body of the animal, as in the common sand worm *(arenicola piscatorum)* or in the sea mouse *(halithæa aculeata)*. A third form of the respiratory apparatus exists in those forms of the annelides adapted to live in air as well as water, such as the leech or the earth worm; here we lose the external gills, and find in their place a series of small sacs, opening from the sides by small orifices, termed *stigmata*, and extending into the interior of the body; presenting us with a simple but interesting condition of the complex respiratory apparatus of insects.

In the myriapodes, of which the centipede may be taken as an example, the same structure exists, but in a less simple form, presenting us with the intermediate stage between that of the air-breathing annelides, and of insects. The respiratory apparatus of the latter class offers some beautiful analogies with the corresponding system in plants. It consists of a vast number of *tracheæ*, or air passages, which ramify in extremely minute divisions throughout the smallest parts, and which open by *stigmata*, or

minute apertures in the sides of the body; and it is not a little remarkable that the middle tunic of the three which compose these tubes, should be formed of spiral fibres, which may be drawn out like the spiral vessels of a plant; the tubes being thus provided with elasticity sufficient to prevent them from being obstructed by compression. It is impossible to study the manner in which the air is thus brought into contact with the blood in the minutest textures of the body, without being struck with the method by which the limited circulation of the fluids is compensated by the extensive distribution and complex ramification of the respiratory apparatus, and by which the necessary lightness, elasticity, buoyancy, and muscular energy are imparted to the bodies of these beautiful and interesting inhabitants of the air. It is also worthy of remark, that this very high degree of respiratory power is given, not by a sudden advance to a more complicated system of organs, such as exist in the vertebrated classes of animals; but by an extension of the comparatively simple plan of which we observed the first traces in the annelides; thus affording a beautiful example of the great law of unity of type in the development of organs, which has few apparent and perhaps no real exceptions.

In many of the arachnides, we observe a state of the respiratory apparatus which may be considered as a more concentrated form of that of insects, and perhaps as a transition to a higher type. In the spider, for instance, there are numerous distinct sacs opening from the sides of the abdomen, into which the air freely enters; but their interior, instead of being smooth, has a laminated or pectinated character, partaking of the structure of gills, or perhaps presenting an approach to that separation into distinct cells which characterises the lungs of higher animals. From the analogies which they present to both classes of organs, Dr. Audouin denominates them pulmonary branchiæ.

In the crustacea, the respiration is aquatic, being performed by pectinated gills, which are usually placed on the under surface of the body, and generally in connection with some very moveable parts. In some kinds of crustacea, as the land crab, there is a special apparatus for keeping the gills in a moist state when at a distance from the water, and thus enabling them to be acted on by air.

The molluscous classes present great variety in the form and situation of their organs of respiration, although they are all, with but a few exceptions, inhabitants of the water. Most of them are remarkable for the slowness of their movements, and many are entirely fixed; and it is beautiful to observe how all of them, even the most inert, are provided with the means of renewing the fluid in immediate contact with their bodies, so as to aerate and renovate the blood. Although the form and position of the gills varies much in the different classes, their general structure is the same in all; they consist of delicate membranous folds or tufts, minutely reticulated with blood-vessels, and covered with vibratile cilia, by

the action of which constant and regular currents are produced. These cilia are also placed around the branchial apertures, and often fringe the margins of the mantle. In some cases, however, the gills are placed externally to the mantle, occasionally forming membranous processes like fins, as in some of the pteropodes. Many of the gasteropodes are terrestrial, and are consequently modified for aeriform respiration. In the snail, for instance, we find an opening on the right side of the body, which leads to a capacious highly vascular sac destined to receive atmospheric air; this sac is placed nearly in the middle of the back, the position in which we find the air bag in fishes.

In this slight sketch of the development of the organs of respiration in the invertebrata, we observe that the entire covering of the animal is subservient to this function in the lowest tribes; but, as we rise higher in the scale, we find a portion of the surface specially modified for the aeration of the blood, forming the gills or pulmonic cavities, which are situated in the most convenient position for receiving that fluid and submitting it to the influence of the surrounding element. It is also interesting to remark, that these organs do not, as yet, communicate with the mouth, which is an organ solely appropriated, in these lower classes, to the reception and subdivision of the food; and that the movements by which respiration is assisted, are, in most cases, those of the body at large.

There are scarcely any organs which present greater diversities of form among the vertebrated classes, or which undergo more marked changes during development, than those which are appropriated to the aeration of the blood; and these diversities of form are most intimately connected with the living condition of the animals, and the vital energies they are capable of displaying. In the slow moving reptile, as in the mollusca, where the respiration is small, it may be suspended for a time without inconvenience; but in the active inhabitants of the air, birds as well as insects, where this function is necessarily of great extent, its suspension quickly proves fatal to life. If we keep a bird in a limited quantity of air until it ceases to respire, and then place successively in the same atmosphere a dormouse, a frog, and a snail, each of these animals will continue to breathe for some time in a medium which the former one had vitiated too much to continue to support its own respiration.

Although the respiratory apparatus in fishes retains the type which characterised the inferior classes, it undergoes great increase, both in extent and importance. In order to keep pace with the rapid advance in the development of the other systems, the respiration requires to be conducted, though by means of an aquatic element, with great velocity and effect. For this purpose, it is not sufficient that fishes should have merely ciliated tufts, hanging loosely at the sides of the neck; but it is requisite that they should have the means of rapidly and constantly propelling large streams of water over their surface; and of forcing the whole blood of the

system, by the action of the heart, through the respiratory apparatus, to be submitted to the action of the air that is contained so scantily in the water. The former of these ends is effected by the connection of the gills with the cavity of the mouth, the muscles of which send a rapid current of water through the branchial passages; and the latter, by the position of the heart, which is placed so as to affect the respiratory organs previously to the system at large. The gills in most fishes are disposed in fringed laminæ, the fibres of which are set close to each other, like the barbs of a feather, and which are attached on each side of the throat, in double rows, to the convex margins of four or five osseous or cartilaginous arches which are very similar to the ribs. The extent of surface exposed by these gills is very great. Dr. Monro computed that in the skate the surface of the gills is at least equal to that of the human body. The water impelled through them finds its way out by one large opening on each side of the neck in the osseous fishes, or by five small ones in the cartilaginous species. These are called branchial openings; and it has been asserted by several continental anatomists, that analogous openings may be very distinctly seen, at an early period of the development of all higher animals, not excepting man himself; thus adding a very beautiful confirmation, if it were necessary, to the general law that each of the systems of higher animals, in the progress of its development, passes through a series of forms analogous to those which remain permanent in the lower parts of the scale.

In considering the respiratory organs of fishes, we must not omit the air bladder, which is now generally regarded as the rudimentary state of the complex lungs of the higher vertebrata. In many fishes, as in the embryo of mammalia, it is a simple shut sac, placed along the middle of the back. In others it has a division of its cavity by one or more membranous partitions. This air bag usually communicates with some part of the alimentary canal near the stomach, by means of a short wide canal termed the *ductus pneumaticus;* but sometimes, as in the sword fish, it has no manifest opening; and we find connected with it a glandular and highly vascular organ, which has been supposed to secrete the gas which it contains. The uses of the air bag are involved in great obscurity. It cannot be necessary to regulate the specific gravity of the fish, for we often find it absent. The gas contained in it differs from atmospheric air in its constitution: in the fishes which inhabit deep seas, which are generally more muscular and powerful than those which live near the shore or in fresh water, there is a considerable preponderance of oxygen; and the proportion of nitrogen is increased in those which come often to the surface. The diodon, or globe fish, has a very large sac communicating with the œsophagus, which it has the power of filling by swallowing air at the surface of the water, by which means the whole body is blown up, and rendered tense and spherical, the spines covering it are erected, and the animal floats on the sea, quite secure

from the attack of either birds or fishes. The air bag is wanting in those fishes which lie in the bottom of the sea, or in mud, such as lampreys, rays, flounders, &c. From the great vascularity of this organ, where it exists, joined to other circumstances, and especially its analogies with the respiratory apparatus of some of the amphibia, it appears probable that it is in some way subservient to respiration, although its precise function has not been ascertained. In many fishes, the membrane lining the alimentary canal appears to be likewise subservient to respiration; for they may sometimes be perceived to swallow air, which is ejected as carbonic acid gas.

There are few, if any, instances in the animal kingdom, where we may so clearly perceive the transition between two great classes, differing extremely in the relative development of their various systems, and in the media they are destined to inhabit, as we may between fishes and amphibia. We are not to suppose, however, that this transition is really more gradual than in other cases; but it is more evident, and in its general outlines is familiar to every one. The embryo of each of the higher orders passes through a succession of these forms; but they can only be traced by the hand of a skilful anatomist.

All of the class amphibia, (otherwise called Batrachian reptiles,) when young and imperfect, inhabit the water solely, and are therefore provided with organs for aquatic respiration, precisely analogous to those of fishes. In all instances the branchiæ are at first external, hanging like tufts from the neck; and this state continues through life in the proteus, siren, axolotl, and other genera of the family of perennibranchia. In those, however, whose development proceeds further, we soon observe that these external gills disappear, and internal branchiæ are formed precisely similar to those of fishes. As the animal advances towards its final change, these disappear in their turn, and lungs are developed by which it breathes air for the remainder of its life. These changes are of course accompanied by great alterations in the circulating apparatus; and indeed all the systems undergo a very rapid transformation. Dr. Edwards has shewn that a tadpole may be prevented from becoming a frog at the usual period, by diminishing the quantity of light and heat to which it is exposed; and that by the want of these stimuli, it will continue to grow in its imperfect state, without advancing itself to a higher form.

It appears as if in the family of perennibranchia, the process of development had been stopped at an early stage; so that the adult state of these animals corresponds with the larval condition of the frog. We find them possessed of rudimentary lungs, in the form of simple vascular membranous sacs, very similar to the air bags of fishes; and the tube by which they open into the mouth bears a much greater analogy in structure to the ductus pneumaticus, than to the tracheæ of higher animals. It would not be difficult to trace the gradual ascent in the openings of these air bags or pulmonary organs, from their being completely closed sacs in many fishes

(as in the earliest condition of air-breathing animals) to their entrance into the stomach, the œsophagus, and even the mouth. From the simple undivided condition of the air bags themselves, we find them gradually more complex in their structure, and more subdivided internally, (as in the frogs and land salamanders,) so as to present a larger surface for the ramification of the blood vessels. There is very great variety in the relative degrees of aerial and aquatic respiration in the family of perennibranchia, of course depending on the comparative development of their organs. Thus in the siren, the pulmonic respiration is more extensive and important than the branchial; but the reverse is the case in the proteus.

All the amphibia are covered with a soft skin, which answers such an important purpose in the function of respiration, that if it be covered with oil or grease, so as entirely to prevent the access of air, the animal will die; while if, on the other hand, the lungs be removed, or the access of air to them be prevented, the animal will be supported for some time by its cutaneous respiration. It is also remarkable, that as none of the amphibia are provided with ribs or a diaphragm, air can only be forced into the lungs by a process resembling swallowing; and a frog may thus be prevented from inspiring air by holding his mouth open.

In serpents we usually find a long cylindrical sac, only divided into cells at its upper part, and generally extending along the tail. In some genera, however, this sac is double; and where there is only one, it is that on the right side which is developed, the other remaining in its rudimentary state. From the great capacity of the respiratory sac, the mobility of their ribs, and the power of their intercostal muscles, serpents are capable of rapid and extensive inspiration and expiration, which contributes to the energy of all their muscular exertions. In the aquatic serpents, the large volume of air contained in the lungs serves to buoy up their heavy and slow moving bodies in that dense element; and its expulsion gives rise to the long continued hissing sound by which these animals sometimes alarm their prey.

In the saurian reptiles, we still find a very imperfect subdivision of the pulmonary sacs; but they are equally developed on both sides of the body. In the lower genera of this class, there is scarcely any appearance of cells; but when we have advanced upwards to the crocodile, we find the lungs, though externally small, subdivided to a great degree of minuteness by internal partitions; and we also find a rudimentary condition of the diaphragm, which is entirely wanting in all the inferior genera. In the chamelion, for instance, the lungs extend under the skin of the whole trunk; and their fulness or emptiness of air give rise to the plump or lean appearance, either of which this remarkable animal has the power of assuming by the simple process of inspiration or expiration. How far the state of the lungs is connected with the change of colour, is a question not as yet satisfactorily determined.

The structure of the lungs of the chelonian reptiles is very similar. They are very capacious, and have few subdivisions; and by the quantity of air they contain, materially assist to buoy up the heavy trunk of these animals when sailing on the surface of the water. The chelonia fill their lungs by the deglutition of air, in the same manner as the amphibia, serpents, and saurians.

The respiratory apparatus of birds is intermediate in the perfection of its development between that of the reptiles and of the mammalia. In birds, as in insects, it extends through a great part of the body; many of the cells of the lungs are still contained in the abdomen, and are even continued beyond the cavity of the trunk, as under the skin of the neck and extremities. Even the bones are made subservient to this function; for we find them hollow, and in communication with the lungs. Birds begin their career, however, like reptiles, by having a spongy texture in the interior of their bones, filled with thin marrow. This, in general, is gradually displaced by air; but in the aquatic species, the original condition is retained through life. We may remark, that in birds, as in insects, the great extent of respiratory surface is given by a simple increase in the capacity of the sacs, and not by that minute subdivision into cells, which characterises the highest form of the respiratory organs. No diaphragm exists in birds, excepting in the ostrich, which forms a transition to the class mammalia; and from the manner in which the lungs are connected with the walls of the chest, the state of fulness is natural, and that of emptiness is forced. The five branchial openings and arteries, which have been already referred to, may be distinctly seen on the neck of the embryos of birds, between the third and eighth days of incubation.

The respiration of quadrupeds is more confined to the lungs, and less extended through the system than in birds; and though the lungs are proportionally less capacious than in birds or in many reptiles, they present an immense surface, owing to their minute subdivision into cells. The muscular partition between the two great cavities of the trunk is here completed, and the respiratory organs are confined to the thorax. They are greatly developed in all the more powerful mammalia, as in the carnivorous species; but they are comparatively smaller in their extent of surface in the feeble and inferiorly-organised herbivora. The varieties of these organs, presented by the different orders of quadrupeds, relate chiefly to their exterior divisions, and to their greater or less capacity; the plan of structure being nearly the same in all.

Thus we observe that there is great uniformity in the development of these organs in the vertebrated tribes; and a beautiful adaptation in all the forms of the respiratory apparatus, to the living conditions of the animals, and the place they occupy in the scale of beings.

(To be concluded in our next.)

ON THE CULTURE OF WHEAT

As a source both of Domestic Supply and Foreign Trade in the British West Indian Islands.

BY WILLIAM HAMILTON, M. B.

It is a fact, well known to all who are acquainted with our West Indian colonies, that the whole of the wheaten flour consumed by their inhabitants is the produce of countries situated without the tropics, and principally of the United States of North America. That such a dependence upon foreign countries for the supply of so essential an article of human sustenance as wheaten flour, may not only be unattended with inconvenience, but even productive of commercial advantages in ordinary seasons, and in peacable times it is not my object to deny; but as it is sufficiently notorious that our West Indian islands have frequently felt the injurious effects of this dependence, when the source of supply has been accidentally interrupted by the occurrence of hostilities, or the failure of the crops in the districts from which they have been accustomed to receive it—an inquiry into the practicability of raising a supply of wheat sufficient perhaps for their own consumption, if not redundant enough for exportation, within their own islands, can hardly be unwelcome or uninteresting to those immediately connected with the colonies; or to those whose enlarged views embrace within their comprehensive grasp the general welfare of the British empire throughout its vast extent.

The interest of such an inquiry, however, is not to be regarded as confined to these two, and comparatively small classes of the British community, but extends in fact to every individual throughout the empire. Great Britain, it is well known, hardly produces, even in the most favourable seasons, a sufficiency of wheat for her own overgrown and daily-increasing population; but is dependent, as well as her West Indian dependencies, for a large proportion of her supply of wheat upon foreign and independent states, with which her amicable relations are subject to be broken off by the intervention of hostilities, or the copiousness of her supply impaired by the inclemency of the seasons, and the consequent failure of the foreign crops. The same inclemency which exerts so baneful an effect upon the crops in those countries from which Great Britain is accustomed to draw her supplies, usually extends its influence, from the similarity of climate, to this country, producing a corresponding deficiency in the crops, and augmenting the general distress by the hopelessness of obtaining relief from without.

Other reasons might be given to shew the extensive interest which an inquiry like the present is calculated to awaken in the minds of the statesman, the political œconomist, and the philanthropist; enough however has, it may be presumed, been said to shew the importance of the question as connected, not only with our colonial, but, if possible, still more with our domestic wants.

At an early period after the conquest of South America, the corn of Europe, as we learn from that intelligent and inquisitive traveller, Baron Von Humboldt,* was successfully cultivated in regions which are now regarded as too hot or too humid, for the successful prosecution of this branch of agriculture. The first settlers from Europe, wedded to their ancient tastes and habits, fastidiously rejected the novel flavour of the Indian corn,† and looked for the harvests of Spain amidst the forests of Columbia.

With this object alone in view, with minds undazzled by specious theories, and unbiased by partial interests, these early adventurers, without stopping to ascertain the comparative advantages of the culture of the cane, the cerealia, the coffee or the cotton, boldly interrogated nature, and tried seeds of every description, without wasting their time in idly theorizing upon their possible success.

The successors, however, of the original *conquestadores,* being born in America, and losing their predilection for European luxuries in proportion as they receded from their primitive stock, became progressively indifferent to the cultivation of the *cerealia* of their forefathers; and the importation of negroes from Africa, by facilitating the culture of the cane, and other objects of greater profit, completed the expulsion of the wheat cultivation from most of those situations in which sugar or coffee could be cultivated to advantage. Thus, as Humboldt acquaints us, upon the authority of Don Ignacio de Pombo,‡ an intelligent merchant of Carthagena, and the friend of the lamented Mutis, wheat was cultivated in the province of Carthagena, "crossed by the mountains of Maria and Guamoco," "till the sixteenth century."§ This culture, he also informs us, is very ancient in the province of Caraccas, "among the mountainous lands of Tocuyo, Quibor, and Barquesimeto, which connect the littoral chain with the Sierra Nevada of Merida. It is still happily practised there, and the environs of the town of Tucuyo alone export annually more than eight thousand quintals of excellent flour."|| He immediately, however, adds that "though the province of Caraccas, in its vast extent, presents several spots very favourable to the production of European corn, I believe this branch of agriculture will never become of great importance there. The most temperate vallies are not sufficiently wide; they are not real table lands, and their mean elevation above the level of the sea is not considerable enough for the inhabitants to avoid perceiving that it is more their interest to establish plantations of coffee than to cultivate corn." Hence, in place of raising even a sufficiency for their own domestic consumption, we find the inhabitants of regions in which Humboldt witnessed, in the year 1800, at an elevation of from two hundred and seventy to three hundred toises, or

* Pers. Narr. vol. 4, p. 112. † Zea Mayz.

‡ Informe del real Consulado de Cartagena de Indias, 1810, p. 75.

§ Personal Narrative, vol. iv. p. 112. || Humb. l. c.

about seventeen hundred and twenty-six and a half to nineteen hundred and eighteen English feet only, above the level of the sea, fields of corn mingled with plantations of sugar canes, coffee, and plantains, dependent upon Spain and the United States for the principal part of their wheaten flour.

The same causes which have operated to the injury of the cereal agriculture of the province of Venezuela, have operated with increased force in precluding its introduction into the islands of the West Indies, in none of which a trace of its existence is to be found prior to the year 1835, with the exception of the district of Quatro Villas, in the interior of the island of Cuba, where we find extensive fields of wheat successfully cultivated at an elevation little exceeding that of the level of the sea.

The abolition of slavery, however, in our English islands, conjointly with the increasing cultivation of the cane by which the market price must shortly fall below a remunerating amount, and the equalization of the duties on East and West Indian Sugar, which must ultimately be conceded to the wants and demands of the nation, by removing those dazzling temptations which have hitherto created an injurious prejudice in favour of the cane, the cotton, and other colonial staples, cannot but prove favourable to a fuller development of the natural resources and capabilities of our West Indian islands, and the introduction of new, and hitherto unthought-of objects of colonial agriculture.

Among these the cultivation of the cerealia will most probably not be the least important, whether we view it as a source of supply for the domestic consumption of the colonies themselves, or of exportation to other countries.

It is, as Humboldt very justly remarks, an error that has hitherto too generally prevailed under the tropics, to consider grain as plants which degenerate on approaching the equator, and to suppose that the harvests are more abundant in the northern climates; and modern inquiries have shown that, beyond the latitude of 45° the produce of wheat is no where so considerable, as on the northern coasts of Africa, and on the table lands of New Granada, Mexico, and Peru. The return obtained in the vicinity of la Victoria and San Matheo, is stated by Humboldt to be twenty for one, while the surface of France yields, according to Lavoisier, a mean only of five or six for one. In Jamaica, as we shall presently see, without taking into our estimate the effects of tillering, the return varies at elevations of from two to four thousand feet above the level of the sea, and consequently at elevations exceeding those at which wheat is cultivated near la Victoria, by from two hundred and ninety-three to two thousand two hundred and seventy-three feet, a return has been obtained of from fifty-three to fifty-six for one. While the mean temperature of the year throughout its whole extent, even in the arid lands of Venezuela, at an elevation of only five hundred and twelve feet above the level of the sea,

only exceeds the mean temperature of the three months of summer in in Barbary and Egypt, both most fertile in the production of wheat, by less than eight degrees of Fahrenheit.

What the peculiar circumstances are which regulate the inferior limits of corn within the tropics, is a problem for the satisfactory solution of which sufficient data have not yet been collected; but, as Humboldt remarks, "the fine harvests of Egypt and of the kingdom of Algiers, with those of the valleys of Aragua and the interior of the island of Cuba, sufficiently prove that the augmentation of heat is not prejudicial to the harvest of wheat and other alimentary grain, unless it is attended with an *excess* of drought or moisture;" and we are not warranted in pronouncing, in the absence of direct experiment, the cultivation of fields of wheat in situations at this moment occupied by the most flourishing pieces of canes in the low lands of Jamaica, to be impossible, were the selection of the season so judiciously made, as to preclude the danger to be apprehended from these two extremes. It is even probable that the dry and barren plains of Cumanà and Venezuela, which, in the intervals between the rainy seasons, hardly exhibit a trace of vegetable life from the excess of drought, might during the periods of the rains be brought to exhibit fields of waving corn loaded with abundant ears, which the returning season of drought would soon render fit for the sickle.

We learn from Humboldt, with surprise, that while to the east of the Havanna, in the famous district of Quatro Villas, the inferior limit of wheat descends nearly to the level of the ocean; to the west of the same point, on the slope of the mountains of Mexico and Xalappa, the luxury of vegetation is such, that, at an elevation of six hundred and seventy-seven toises, or four thousand three hundred and twenty-nine feet, an elevation considerably greater than that at which wheat has been recently proved to be capable of cultivation in Jamaica, the wheat does not form ears. What the peculiar circumstances of this region are, which produce such a result, it would require a local acquaintance with the spot to pronounce; but the cause of failure is probably to be sought in the excessive humidity of the atmosphere from the quantity of uncleared forests, or the injudicious selection of the seasons for the experiment. Something also should perhaps be allowed for the redundant fertility of a soil enriched by the accumulated deposits of vegetable matter during centuries of repose; but to whichever of these causes the failure is to be attributed, we may not unreasonably conclude that, with the progress of civilization, the increase of population, and the march of agriculture, these causes of failure will progressively disappear, and the gifts of Ceres extend their blessings from the elevated table lands, to those forest-clad slopes whose present luxuriance of vegetation prevents the wheat from forming ears.

Previous to the experiments made during the present year in the island of Jamaica, under the scientific auspices of the philanthropic Bancroft,

with wheat sent by Sir Robert Kerr Porter, first to England, from Caraccas, and thence to that island, the results of which experiments I am about to state, no attempt, that I am aware of, had been made to cultivate this grain in Jamaica. That the result of these experiments, especially when made with grain naturalized by a domestication of about three centuries within the tropics, should be satisfactory, was what the example of Cuba naturally led him to anticipate: and it only remains to vary these experiments, at progressively decreasing elevations, and under every possible variation of climate, season, and humidity, to determine the extent to which wheat cultivation admits of being carried with advantage in our West Indian possessions, and what are the lowest limits of elevation at which it can be attempted under the several parallels of latitude. It will also be desirable to repeat the experiments with the various kinds of wheat cultivated in Europe, for the purpose of determining the sort best adapted for West Indian cultivation. To render these experiments more instructive, they should be accompanied by an accurate register of every circumstance of importance connected with them, especially the kind of manure, the nature of the soil, the elevation above the sea, the dates of sowing and of ripening; the interval between sowing and the first appearance of the grain above ground; the rapidity of its growth, the date of the first appearance of the ear; the nature of the weather as to heat, moisture, or dryness, the range of the barometer and hygrometer; the quantity of grain sown, and the amount of the return, with the average weight of the ears, the average number of grains in each, and the number of grains required to weigh half an ounce or an ounce avoirdupoise. By these means a more accurate comparison can be established between the harvests of Europe and the West Indies, and the important problems of the influence of climate, the maximum of temperature, and the inferior limits of cultivation corresponding to the distance from the equator, will be rendered less difficult of solution.

Having thus discussed the question respecting the practicability of cultivating the cerealia in our West Indian islands, and endeavoured to shew the advantages to be anticipated from its adoption, it only remains to shew that this is not mere theory, specious in appearance, but impracticable in execution; and this I am fully enabled to do, by a letter received from Dr. Bancroft, the enlightened president of the Jamaica Agricultural and Horticultural Society, dated "Kingston, Jamaica, July 9, 1835, of which the following is an extract:—

"As you express in your late letters a desire to be informed as to the growth of various plants which you have been the means of introducing here, I will now proceed to give you such particulars of several of them as I have been able to collect to the present time.

VICTORIA WHEAT.

"The Jamaica Society have received samples from three or four different places, of the wheat produced there, all of which appear to be of a favourable sort.

"First, from the mountains of St. Anne's, where the seed had been *sown the latter end of January,* and the corn *was ripe the latter end of April.* In another part of the same district, the dates of sowing differed from the above, but the wheat ripened in nearly the same period.

"Next from the mountains of St. Andrew's. On one property, Fair Hill, (about 2,000 feet above the sea) the sowing and the ripening happened *at the same dates* as in the first mentioned case. Of this corn, *one grain* produced *twenty-eight ears,* containing altogether *fifteen hundred grains,* (being an average of fifty-three grains for each ear). Notwithstanding this apparent success, the proprietor of the place thinks it unlikely that planters would grow the Victoria Wheat in preference to the '*Great Corn,*' as it is called here, i. e. *Zea Mayz.* On another plantation again, Charlottenberg, (about 4,000 feet above the level of the sea,) the seed was *sown early in March,* and received a top dressing: in the course of a few days it had already sprung up three inches above ground; and, as favourable moderate rains continued to fall subsequently, the corn throve well, and *ripened in the early part of June,* producing *abundantly* grain of *a larger size than the parent seed;* the ears being large and full. Six of these, for instance, yielded *three hundred and thirty-six grains, weighing three ounces,* making *an average of fifty-six grains, weighing half an ounce,* to each ear. Mr. W. B. King, an assistant Judge of Assize, and Member of Assembly, has since sent me two bundles of the ears of his wheat, and I intend to enclose one or two of them as a specimen of the produce of the Victoria wheat here. From the trial, just made, Mr. King has no doubt that this grain *could be cultivated in many parts of this island,* and that it *might become a profitable resource.*"

Such is the result of the experiments made under the immediate auspices of this enlightened and benevolent individual, and the most sanguine expectation could hardly have anticipated any thing more conclusive or more satisfactory.

The wheat which was the subject of these experiments, was of that kind cultivated in the environs of La Victoria and San Matheo, spoken of by Humboldt, in the fourth volume of his Personal Narrative, as being sown there in the month of December, and the harvest reaped on the seventieth or seventy-fifth day, an interval corresponding with singular accuracy with the account given above by Dr. Bancroft. Of this wheat Humboldt says, that its grain is large, white, and abounding in gluten; having a thinner and softer pellicle than that of the wheat raised on the cold table lands of Mexico. He states the produce of an acre (*arpent des eaux et forèts,* or legal acre of France, of which 1.95 make an hectare, being equal to about one acre and a quarter English,) as amounting usually from three thousand to three thousand two hundred pounds weight, being at the rate, for an English acre, of from two thousand one hundred and sixty to two thousand five hundred and sixty pounds; the growth of what we may conclude to be

an alluvial soil, from what Humboldt says, at page 101, of the aspect of the situation of Victoria, the approach to which was marked by the ground becoming smoother, and looking like the bottom of a lake, the waters of which had been drained off, while the neighbouring hills, only one hundred and forty toises in height, were composed of calcareous tufa; their abrupt declivities projecting like promontories into the plain, and seeming by their form to indicate the ancient shore of the lake. The elevation of the cultivated ground is fixed by Humboldt at from 270 to 300 toises (about 1726.51, to 1918.35 English feet) above the level of the sea, an elevation from 81.65 to 273.49 English feet below that of Fair Hill, in the mountains of St. Andrews, Jamaica, where a single grain yielded from twenty-eight ears a return of fifteen hundred for one.

The seed was obtained by me direct from Caraccas, where Sir Robert Kerr Porter procured it from the place of its growth, and was transmitted by me a second time across the Atlantic, to Dr. Bancroft; hence no doubt can be entertained of its being the genuine wheat spoken of by the illustrious traveller from Prussia. This wheat having been acclimated by such a lengthened period of cultivation within the tropics, was undoubtedly the most proper for the commencement of these experiments; but it will neverthless be desirable to follow them up by trials with other varieties of wheat cultivated in Europe, some of which, without being inferior in precocity to that of Victoria, may prove perhaps, if possible, more prolific. The advantage of a top dressing has been seen, in the experiment tried by Mr. King on his estate at Charlottenberg, four thousand feet above the level of the sea, (where the *Trifolium incarnatum* has also flourished vigorously, and ripened its seed,) and hence the importance of attending to this, and varying the experiments with lime and other sorts of manure, is evident. Altogether, the subject is one which merits the consideration, not only of the Colonial Legislatures, but of the British Parliament.

Plymouth, *August* 24, 1835.

(To the Editor of the West of England Journal.)

My dear Sir,

While pointing out to a friend a few of the principal geological features of this district, I was induced to examine that portion of Clifton Down, near to the observatory, which in the various geological sections of that part, particularly those in the first volume of the Geological Transactions, second series, is coloured as a dyke in the carboniferous limestone, filled with magnesian or dolomitic conglomerate, represented by a wall of about one hundred feet long, fifteen feet high, and from three to seven feet thick, standing out abruptly in a southerly direction from the great mass of St. Vincent's rocks.

The error in considering this as a dyke of conglomerate, must have

originated in consequence of the highly comminuted state of the carboniferous limestone at this spot; the cracks and fissures being filled with variously-coloured calc spar, hæmatitic iron ore, sulphate of barytes, and crystals of quartz, giving it, on a cursory view, the appearance of a brecciated rock.

Such errors often become established and perpetuated by various authors who copy from each other, and although in themselves of little consequence taken generally, become important when considered locally; embarrassing the student, who surrenders his own judgment to the authority of those who first made the mistake, and to the apparent corroboration of those who have in fact merely copied the error from what they have considered good and sufficient authority.

This wall of rock appears to have originated from the accidental circumstance of two considerable vertical fissures having occurred parallel to each other, within the short distance of the thickness of the wall, those portions of the rock both to the eastward and to the westward having been quarried away, leaving the intermediate rock standing.

Such fissures or veins are not uncommon, running parallel to each other, constantly in the direction of the present magnetic axis, viz. from north to south, while smaller veins may be traced branching from them in different directions, filled with beautifully-coloured spar, and containing occasionally the bones of herbivorous quadrupeds.

Two more such fissures may be distinctly traced at a small distance to the westward of that which has been considered as magnesian, of which formation indeed not the slightest portion can be traced on the observatory down, while on the less elevated down of Clifton, particularly at the section made by the new road, the formation is exceedingly well shewn, the conglomerate reposing horizontally on the inclined strata of the upper limestone shales and grits, thrown down by the great fault.

Another favourable situation for the observation of these vertical veins is in the quarry called the great white quarry, on Durdham Down, in one of the veins in which may be detected angular fragments of a white oolitic limestone, cemented by calc spar and galena crystallised in ex-cubes.*

Yours truly,

S. STUTCHBURY.

Institution, *Sep.* 4, 1835.

* Specimens of which may be seen in the museum of the Institution.—Ed.

A CATALOGUE

OF THE

MOST INTERESTING VASCULAR PLANTS GROWING WILD IN THE NEIGHBOURHOOD OF BRISTOL.

BY MR. H. O. STEPHENS.

(Concluded from p. 166.)

Trigynia. Nat. Ord. Caprifoliaceæ.

Viburnum Lantana. Leigh Woods. May.

——— Opulus. Guilder Rose. Shirehampton. June.

Sambucus Ebulus. Dwarf Elder. Hedges and orchards about Chew Magna, used to rub the floors of cheese lofts; the peculiar odour of this plant is supposed to destroy mites. Sambucus nigra is likewise thought to be destructive to insects.

Pentagynia. Nat. Ord. Plumbagines.

Statice Armeria. Thrift. Banks of Severn at Clevedon.

——— Limonium. Sea lavender. Muddy banks of the Severn. July, September.

Nat. Ord. akin to Caryophylleæ Juss. Lineæ Hooker.

Linum usitatissimum. Flax. Near St. George, New Church.

Hexandria Monogynia. Nat. Ord. Spathaceæ Linn. Narcissi Juss.

Galanthus nivalis. Snow Drop. About Hutton, Somersetshire. Mr. Rogers. Orchards at Barrow. February, March.

Narcissus biflorus. Hutton. Mr. Rogers.

——— Pseudo-Narcissus. Daffodil. Meadows and banks of the brooks about Bower Ashton. March.

Nat. Ord. Asphodeleæ.

Allium Ampeloprasum. Round Headed Garlic. Steep Holmes, Withering. July.

——— vineale. Crow Garlic. About Brislington, Clifton rocks.

——— oleaceum. Fields about Ashley.

Nat. Ord. Liliaceæ.

Tulipa sylvestris. Withering on the authority of Rev. Mr. Ellicombe, says this plant grows in corn fields at Bitton. I have been informed so from other sources. April, May.

Nat. Ord. Asphodeleæ.

Ornithogalum pyrenaicum. Star of Bethlehem. About Conham. Hedges under Keynsham Lodge, as you go from the Bath road to the Ferry. Stockwood. June.

Nat. Ord. Asphodeleæ Brown.

Asparagus officinalis. Alluvial land below King's Weston.

Scilla autumnalis. Autumnal Squill. Point of land stretching from the Clifton Observatory to the rock. August, September.

Nat. Ord. Asparageæ.

Convallaria majalis. Lilly of the Valley. Leigh Woods. May.
——— Polygonatum. Solomon's Seal. ditto May, June.

Trigynia. Nat. Ord. Polygoniæ.

Rumex. sanguinea. Bloody Dock. Banks of Avon under Leigh Wood.
——— pulcher. Fiddle Dock. About Stapleton.

Nat. Ord. Juncagineæ.

Triglochin palustre. Arrow Grass. Bogs under Cook's Folly.
——— maritimum. Muddy banks of the Avon.

Nat. Ord. Melanthaceæ Brown.

Colchicum autumnale. Meadow Saffron. About Brislington, banks of the river. Chew Magna. September.

Octandria Monogynia. Nat. Ord. Onagrariæ.

Ænothera biennis. Evening Primrose. Plentifully about Weston-Super-Mare. Mr. G. Rogers.

Nat. Ord. Gentianeæ.

Chlora perfoliata. Yellow Centuary. Leigh and Clifton Wood, about Knowle, common in this vicinity. June, September.

Nat. Ord. Thymileæ.

Daphne Laureola. Wood Laurel. Copse near the gates of Mr. Miles's, late Lord De Clifford's mansion, King's Weston. February, March.

Tetragynia. Nat. Ord. Sarmentaceæ Linn. Asparagineæ Juss.

Paris quadrifolia. Leigh Wood, ascending the path opposite the Black Rock. Varieties with three and five leaves. May, June.

Nat. Ord. Saxifragiæ.

Adoxa Moschatellina Moschatel. Damp hedges banks about Stapleton Bridge, &c. April, May.

Enneandria Hexagynia. Nat. Ord. Butomeæ.

Butomus umbellatus. Flowering Rush. Banks of the Froom. June, July.

Decandria Monogynia. Nat. Ord. Pyrolaceæ.

Monotropa Hypopitys. Yellow Bird's Nest. Leigh Wood. Dr. Dyer.

Nat. Ord. Ericæ. Bicorne, Linn.

Arbutus Unedo. Plantations King's Weston, not indigenous.

Digynia. Nat. Ord. Saxifragiæ.

Chrysosplenium alternifolium,
——— oppositifolium, } Golden Saxifrage. C. alternifolium. Near a small stream in a field left side of the river going from Bristol to Pill,

about two miles and a half from Rownham Ferry. Mr. G. Rogers. C. oppositifolium is common on moist situations.

Saxifraga umbrosa. London Pride. Wood above Westbury. June.

——— tridactytites. St. Vincent's Rocks. July.

Nat. Ord. Caryophylleæ.

Saponaria officinalis. Soapwort. Banks of the Avon, Conham. July, August.

Dianthus deltoides. Glen behind Avon Farm, near the Ferry, Keynsham.

——— cæsius. Rock Pink. Cheddar Rocks, walls about the Cloisters. Mr. Rogers. Walls about Henbury. This is a very rare plant; about fifteen years ago a relative of the writer's brought a plant from Cheddar, which was planted on a garden wall at Montpelier (Bristol,) it propagated itself readily by seed so as to cover a great portion of the brick coping; some ladies of the writer's family, anxious to adorn Clifton rocks with this charming little pink, sowed a large quantity of the seed, in various places about the Zigzag, &c. but to their astonishment, with no success, and yet the soil and situation are the same as those of its native habitat at Cheddar. We should be glad to know how it was introduced upon the walls of the Cloisters, and shall be obliged by any information upon the subject.

Trigynia.

Arenaria peploides. Weston-Super-Mare.

——— tenuifolia. Under St. Vincent's Rocks.

——— rubra. Brandon Hill.

——— serpyllifolia. ditto.

——— marina. Under St. Vincent's Rocks, and banks of the Avon.

Pentagynia. Nat. Ord. Sempervivæ.

Sedum Telephium. Orpine. Woods beyond Conham, St. Vincent's Rocks. August.

——— dasyphyllum. White Stonecrop. Walls about Belle Vue, Clifton. Mr. G. Rogers.

——— anglicum. Walls at Weston Super-Mare. May, July.

——— album. Weston Super-Mare. Mr. Rogers.

——— reflexum. Wall in a lane near Mr. Sergeant Ludlow's house, Stoke. July.

——— rupestre. St. Vincent's Rocks. July.

Dodecandria. Dodecagynia.

Sempervivum tectorum. Sengreene. Wall behind the Unitarian Alms House, Moon Street.

Icosandria Monogynia. Nat. Ord. Rosaceæ.

Prunus Padus. Bird cherry. Leigh Wood.

——— Cerasus. Wild cherry. St. Ann's Wood.

Pyrus communis. Wild Pear Tree. About Lady Smyth's, Stapleton.
—— Malus. Crab. Leigh Wood.
—— Aria. White Beam. Leigh Wood and St. Vincent's Rocks. May.
Spiræa Filipendula. Drop Wort. St. Vincent's Rocks. June, July.

Polygynia.

Rosa tomentosa? Turpentine scented Rose. Quarries at Crew's Hole, where the pennant slabs are worked. June, July.
—— rubiginosa. Sweetbriar. Bank of the Frome, behind Mr. Walker's house, Stapleton.
—— canina. Dog Rose. Everywhere.
Rubas Idæus. Raspberry. Near Redland Court. Mr. Rogers.
—— glandulosus. Blaize Castle Woods.
—— cœsius. Dewberry. Hedge banks and under walls.
Potentella verna. Spring Cinquefoil. St. Vincent's Rocks. April, June.
Tormentilla officinalis. Tormentil. Clifton Down and Wood in abundance.

Polyandria Monogynia. Nat. Ord. Papaveraceæ.

Glaucium luteum. Yellow-horned Poppy. Shore of the Severn, near the New Passage. July, August.
Papaver Argemone. Club-headed Poppy, Corn fields at Stapleton. June, July.
——— dubium. ditto. June, July.

Nat. Ord. Nymphæaceæ.

Nuphar lutea. Brandy Bottle. So called from the decanter-like shape of the fruit, or perhaps from the spirituous odour of the flowers. I have not found Nymphæa alba in this immediate neighbourhood.

Nat. Ord. Cisti. Juss.

Cistus Helianthemum. Rock Rose, St. Vincent's Rocks, common. July, August.

Pentagynia. Nat. Ord. Multisiliquæ. Linn. Ranunculaceæ Juss.

Pæonia corallina. Peony. Steep Holmes, the only habitat in England at present known. May, June.
Aconitum Napellus. Monkshood. I gathered this plant once, on the banks of the Frome at Frenchay. I have been informed that it grows in a wood at Bishport. June, July.
Aquilegia vulgaris. Columbine. Clifton and Leigh Wood, grounds at Piercefield. July.

Polygynia.

Thalictrum flavum. Meadow Rue. Sandy Lane, Baptist Mills. June.
Ranunculus. Crowfoot, Butter Cups. R. Flammula, Ficaria, auricomus, sceleratus, bulbosus, hirsutus, repens, acris, arvensis, parviflorus, aquatilis; all more or less common.
Helleborus viridis. Green Hellebore, Roman entrenchment, Leigh Wood. April.

Helleborus fœtidus. Bear's foot, Setterwort, or stinking Hellebore. Stapleton Wood. March, April.

Didynamia Gymnospermia. Nat. Ord. Labiatæ.

Napeta cataria. Hedges, Wick Cliffs. Mr. Swayne. July.

Verbena officinalis. Vervain. Under St. Vincent's Rocks. August, September.

Mentha hirsuta. Hairy water Mint. Ditches between Horfield and Westbury.

——— arvensis. Corn Mint. About Horfield.

——— rubra et Pulegium. I have found both these mints in this neighbourhood, but cannot recollect the precise places.

——— gentilis var. variegata. Banks of the Frome, near the second Bridge, Stapleton.

Lamium maculatum, in the ditch behind the garden wall of Redland Court, in 1834.

——— incisum. Cut-leaved Nettle. Fields about Stapleton, Rubbish Montpelier. May.

——— amplexicaule. Same situations. May.

Galeopsis Ladanum. Red Hemp Nettle. Corn fields about Horfield.

——— Tetrahit. Borders of fields about Ashley.

Galeobdolon lutcum. Yellow Nettle. Hedges common. July, August.

Betonica officinalis. Betony. Clifton Down, Leigh Wood. July, August.

Stachys palustris. About Crew's Hole and Conham.

——— arvensis. Corn fields Horfield and Frenchay.

——— germanica. Hedges in various places. August.

Marrubium vulgare. Horehound. Brandon Hill. August.

Leonurus Cardiaca. Lion's tail. The Botanist's Guide mentions this plant as being found on rubbish about Bristol. I have never found it.

Chenopodium vulgare. Wild Basil. Hedges about Ashley, &c. Sept.

Origanum vulgare. Organy. Hedge banks between Stoke and King's Weston in great plenty, not uncommon. September, October.

Thymus Acinos. Basil Thyme. St. Vincent's Rocks. June, August.

——— Calamentha. About Crew's Hole. September, October.

Scutellaria galerecolata. Scull Cap. Banks of the Frome. July, August.

Angiospermia.

Bartsia Odontites. Red Bartsia. Corn fields common.

Euphrasia officinalis. Eyebright. Clifton Rocks.

Melampyrum pratense. Cow Wheat. Crew's Hole, &c. common.

——————— sylvaticum. Wick Cliffs. Mr. Swayne. June, August.

Nat. Ord. Orobancheæ.

Lathræa squamaria. Great tooth wort. Roman entrenchment, Leigh Wood, not abundant. April, May.

Nat. Ord. Scrophalarineæ.

Pedicularis sylvatica. Clifton Down. June, July.

Antirrhinum Cymbalaria. Ivy-leaved Snap Dragon. On all old walls in shady situations about Bristol, Redland, Brislington, &c. June to Oct.

——— spurium. Round-leaved Snap Dragon. Horfield. July to September.

——— Elatine. Corn fields about Horfield.

——— Linaria. Toad flax. Stony hedges very common.

——— minus. Dry potatoe fields, Horfield and Stapleton. June, September.

——— majus. Great Snap Dragon. Walls about Redland, Westbury, &c, various colours. June, August.

Digitalis pupurea. Fox Glove. About St. Ann's Wood and Conham in great profusion and luxuriance. Called fox glove, I presume, because it grows in woody glens, and those retired situations on which foxes shelter, not a corruption of Folke's glove, as supposed in Stephenson and Churchill's Medical Botany. Thus we use the terms toad stool, frog's bit, &c. because the plants are found in damp and marshy situations inhabited by those reptiles.

Nat. Ord. Orobancheæ.

Orobanche elatior. Tall broom rape. St. Vincent's Rocks, parasitic upon furze, ivy, &c. September, October.

Tetradynamia Siliculosa. Nat. Ord. Cruciferæ.

Lepidium ruderale. Narrow-leaved Pepper Cress. Rubbish below Lamplighters' Hall. June, August.

——— petræum. Rock Pepper Wort. Walls, St. Vincent's Rocks. March, April.

——— campestre. Mithridate Pepper. Corn field, ascending to Sir J. Smith's, Stapleton.

Thlaspi arvense. Penny Cress, Moon Sixpences. Corn and potatoe fields about Horfield. June, July.

——— perfoliatum. About Montpelier and Ashley. April, May.

Cochlearia officinalis. Common Scurvy Grass. Banks of the Avon. May.

——— Armoracia. Horseradish. About farm yards and wet places

Senebiera Coronopus (Coronopus Ruellii) Swines' Cress. About Rownham, &c. June, August.

Siliculosa.

Cardamine hirsuta. Wall at Redland Court. Mr. Rogers. Leigh Wood. March, June.

Hesperis matronalis. Redland Court. It should not be called *H. inodora.* Dame's Violet. May, June.

Arabis stricta. St. Vincent's-Rock Cress. St. Vincent's Rocks. The only habitat known for this rare plant. May.

Arabis hirsuta. Hairy Wall Cress. St. Vincent's Rocks. June.

Turritis glabra. Tower Mustard. St. Vincent's Rocks. May, June.
Sinapis muralis. Sand Mustard, Wall Rocket. St. Vincent's Rocks. Walls about Clifton, Brick fields at Easton, &c. August, September.

Monodelphia Pentandria. Nat. Ord. Geraniaceæ Jus. Gruinales Linn.

Erodium cicatarium. St. Vincent's Rocks and Common.
——— moschatum. Musky Stork's Bill. Banks of the river under the Rocks. May to October.
——— maritimum. Same situation. June to October.
Geranium sanguineum. Bloody Crane's Bill. About the Zigzag and other parts of St. Vincent's Rocks. July, September.
——— phæum. Dusky Crane's Bill. Wrington, Banks of the stream at Long Ashton. Mr. Rogers. May, June.
——— pratense. Keynsham. June, July.
——— lucidum. St. Vincent's Rocks and common. June, August.
——— rotundifolium. Dry situations common.

Polyandria.

Althæa officinalis. Marsh Mallow. Portishead and Shirehampton Marshes. August.
Lavatera arborea. Tree Mallow. Steep Holmes. July to October.

Diadelphia Hexandria. Nat. Ord. Fumariæ.

Fumaria capreolata. Ramping Fumetory. Hedge at Stapleton. August, October.
——— lutea. Yellow Fumetory. Walls about Brislington, wall opposite the White Hart Inn. June to September.

Decandria. Nat. Ord. Papilionaceæ.—Leguminosæ.

Anthyllis vulneraria. Kidney Vetch. Banks about Clevedon. June, July.
Orobus tuberosus. Heath peaseling, Bitter Vetch. Clifton Woods. April, May.
Lathyrus Nissolia. Grass Vetch. Boggy meadows below Lamplighters' Hall. May.
——— hirsutus. Between Pensford and Bristol. Rev. G. Swayne.
——— sylvestris. Narrow-leaved Everlasting Pea. Hedges beyond the Black Horse, Passage Road. Copse behind White's Hill, Hambrook. July, August.
Vicia sylvatica. Wood vetch. Lanes between Stockwood and Keynsham A very elegant plant. July, August.
Ornithopus perpusillus. Birds' foot. Brandon Hill, and walls about Brislington. May to September,
Hedysarum Onobrychis. Saintfoin. St. Vincent's Rocks. June, July.
Astragalus glycyphyllos. Liquorice Vetch, about Henbury.
Trifolium subterraneum. Under-ground Trefoil. Brandon Hill. May.
——— fragiferum. Strawberry Trefoil. Under St. Vincent's Rocks.

Lotus angustissimus. Under Cook's Folly.
Medicago falcata. Yellow Sickle Medic. Under St. Vincent's Rocks. July.
——— maculata
——— minima } Brandon Hill; under St. Vincent's Rocks.

Polyadelphia Polyandria. Nat. Ord. Hispericineæ.

Hypericum Androsæmum. Tutsan, Woods by the Avon beyond Conham. September, October.
——— quadrangulum. St. John's Wort. Same situation. July.
——— humifusum. Trailing St. John's Wort. In the same Wood. St. Anne's Wood. July.
——— montanum. About Crew's Hole and Conham. September.
——— hirsutum. Hairy St. John's Wort. Wood by the banks of the Avon, between Conham and Hanham Ferry. June, July.
——— pulchrum. Clifton Down. June, July.
——— perforatum. Hedges. Common.

Syngenesia Polygamia Æqualis. Nat. Ord. Compositæ.

Tragopogon porrifolius. Found by Mr. Sowerby, in the meadows below St. Vincent's Rocks. May, June.
Picris hieracioides. Oxtongue. St. Vincent's Rocks.
Sonchus palustris. Marsh Low Thistle. Banks of the Avon at Crews' Hole and Conham. July, August.
Leontodon palustre. Marsh Dandelion. Meadows below Cook's Folly. July.
Apargia hispida. Rough dandelion. St. Vincent's Rocks. May to Sept.
——— hirta. Small ditto. About Clifton Downs. June to August.
Crepis biennis. Hawk's beard. About Clifton Rocks. July and August.
Cichorium Intybus. Succory, Endive. Banks about Keynsham. September, October.
Serratula tinctoria. Saw Wort. Crew's Hole.
Carduus eriophorus. Woolly-headed thistle. Meadows. July.
——— acaulis. Dwarf thistle. Durdham Down.
Bidens tripartita. Water hemp. Crew's Hole. August, September.
Tanacetum vulgare. Common Tansy. Crew's Hole; Baptist Burial Ground, Redcross Street, very luxuriantly. August, September.
Conyza squarrosa. Ploughman's spikenard. St. Vincent's Rocks, Crew's Hole, &c. August, September.
Erigeron canadense. Canadian flea bane. About Crew's Hole, St. Vincent's Rocks. August, September.
——— acre. Blue flea bane. Walls at Stoke Bishop. July, September.
Senecio sylvaticus. About Frenchay. July.
Aster tripolium. Sea star wort. Banks of the river Avon, Lamplighters' Hall. August, September.

Gynandria Monandria. Nat. Ord. Orchideæ.

Orchis bifolia. Butterfly Orchis. Woods under Cook's Folly. June.
———ustulata. Weston-Super-Mare.
———morio, mascula, latifolia, maculata. Moist meadows common.
Ophrys muscifera. Fly Ophrys. Wood under Cook's Folly. Mr. Rogers. I gathered this plant once in Leigh Wood, near the flag staff. The habitat near the Hotwell House is, I believe, exhausted.
Ophrys apifera. Bee Ophrys. On a bank by the road side, near Tickenham. July, August.
Ophrys nidus avis. Birds' Nest. Near the Keeper's Lodge, Leigh Woods.
Neottia spiralis. Ladies' traces. Short turf, ascending the rocks from the New Road towards Clifton Down. Turfy slope at Walton Castle. September, October, November.
Lestera ovata. Tway blade. Leigh and Stapleton Woods. June.

Monœcia Monandria. Nat. Ord. Euphorbiaceæ.

Euphorbia exigua. Least Spurge. Corn Fields at Frenchay. September.

Triandria. Nat. Ord. Aroideæ.

Typha latifolia. Great reed mace. In a brook by the side of the road, Portishead. September.

Nat. Ord. Cyperaceæ.

Carex pendula. Great Sedge. Stockwood.
—— pulicaris. Flea Sedge. Clifton Wood.

Diœcia Tetrandria. Nat. Ord. Lorantheæ.

Viscum album. Misletoe. Apple trees plentifully at Barrow. May.

Monodelphia. Nat. Ord. Coniferæ.

Taxus baccata. Yew. Leigh Woods. March, April.

Cryptogamia Filices.

Ophioglossum vulgatum. Leigh and Stapleton Woods. August.
Osmunda regalis Flowering Fern. Leigh Woods. Mr. Rogers.
Polypodium dryopteris. Leigh Woods, occurring rarely.
Aspidium fontanum. Lane behind Sergeant Ludlow's house, (a very rare species).
———— aculeatum. Prickly Shield Fern. Hedges about the Zoological grounds.
———— angulare. Lane at Stoke; Stapleton and Leigh Woods.
———— Filix fœmina. Female Fern. Leigh Woods.
———— irriguum. Mr. Miles's portion of Leigh Woods.
———— dilitatum. St. Ann's Wood.
———— dumetorum? Stapleton and St. Ann's Wood.
Asplenium Adiantum nigrum. Leigh Woods.
Scolopendrium Ceterach. Walls at Stoke, common.
Blechnum boreale. Hard Fern. Leigh Woods and St. Ann's Wood.

REVIEW.

A Guide to Geology, by John Phillips, F. R. S., G. S., Professor of Geology in King's College, London, &c. Second edition, 1835. 12*mo. pp.* 168. London, Longman & Co.

We have much satisfaction in recommending to our readers this very convenient elementary work, on a science the daily increasing popularity of which has long rendered desirable a compendious introduction, which should sufficiently place its great principles before the general reader, without encumbering him with voluminous details. The present treatise is indeed far less copious than the excellent manual of M. De la Beche (a work of perpetual reference, absolutely indispensable to every one who would enter into the whole field of Geology); but is on that very account so much better suited to the purposes of the more general student, on whose attention it imposes only a small duodecimo of one hundred and sixty-eight pages; while it fully acquaints him with the nature and evidence of those extraordinary facts as to the structure and history of our planet, which this most interesting science has brought to light. It is divided into four parts; in the first or introductory, we find a general statement of the disposition and arrangement, in successive formations, of the stratified rocks, forming nine-tenths of the crust of our globe, together with a notice of the unstratified rocks, by which the former are occasionally interrupted, and a recapitulation of the evidence which leads us to consider the former as subaqueous deposits, and the latter as igneous products. We have then an able sketch of the connection between Physical Geography and Geology, and the manner in which "the surface of the earth derives all its diversity of form and products, from the originally different nature of its constituent rocks, the variety of dispositions into which these have been thrown, and the consequent inequality of effect produced upon them by atmospherical and other modifying agencies," p. 31. The second part is devoted to a more careful examination of the generalisations, to which we were introduced in the former; the proofs of the subaqueous production of the land, and of the elevation of the present continents by the agency of the volcanic eruptions which produced the unstratified rocks before mentioned; the evidence that these elevating convulsions have affected different mountain chains at different periods, of which the relative geological ages can be determined, by observing how many of the successive formations have been affected by them, and which (as having escaped these disturbing forces in every instance) appear to have been subsequently deposited: a very masterly sketch of the general phænomena of the distribution of the various classes of organic remains in the various strata, with the proofs that successive races of varying plants and animals have occupied our planet at various periods, being preserved

in the different formations, as they are of greater or less antiquity, concludes this portion of the work. We may here observe, that it is much to be regretted that the scientific public are yet destitute of any good elementary work on organic remains, and would earnestly recommend to the present author to supply this deficiency, which must ever render all general allusions to the subject in an elementary work on Geology less intelligible to the common reader. The third part of Mr. Phillips's present treatise enters into a fuller descriptive and practical account of the tertiary, secondary, and primary strata, (considered under views exactly similar to those adopted in our own first number) together with volcanic and plutonic rocks; the whole being prefaced by a general list of the principal minerals which enter into their constitution.

A fourth part, or rather appendix, containing tables and calculations, &c. on the physical relations of the globe and its temperature, and on the application and use, for geological purposes, of such instruments as the thermometer, barometer, and clinometer, conclude the work: which is illustrated by a small outline map of the Geology of England, a plate of sections, and a very interesting frontispiece exhibiting the first example of a species of drawing singularly adapted for geological subjects; this consists of a general bird's-eye view of the whole Isle of Wight, supposed to be split through the midst by a transverse fissure, so as to exhibit its constituent formations in sections, while their appearance as actually exhibited in the cliffs of the southern coast is at the same time presented to the view. Mr. Phillips has been for several years favourably known to the geological public by his excellent Survey of the Yorkshire coast; and is also, we believe, a nephew of Mr. Smith, who has been deservedly named the father of English Geology.

On the Connexion of the Physical Sciences. By Mary Somerville. 12*mo. pp.* 493. J. Murray, 1835.

"The progress of modern science," observes Mrs. Somerville, "has been remarkable for a tendency to simplify the laws of nature, and to unite detached branches by general principles." It is to point out these tendencies towards simplicity, and these general principles, indications of which are from so many points apparent, or in other words, to shew the connexion of the physical sciences, that the present volume has been written.

In an age of ignorance men are incapable of judicious observation, and are not sufficiently aware of the distinction between the essentials and accidents of any phænomenon upon which their attention may have been directed; they are unaccustomed to abstract reasoning, and their conclusions are liable to be rendered fallacious by the introduction of unnecessary elements among their data. The form of a rain-drop is observed

to be spherical; and it is observed also, that in a shower the rain-drops adhere to the window, but it is not discovered that both effects depend upon a similar cause, the important law of cohesion. A new law is invented for every phænomenon that is observed, nor does any one observation enable the probable result of another to be conjectured.

But as the mind advances in knowledge, it advances also in powers of discrimination; it learns to distinguish that which is essential from that which is accidental, it becomes capable of abstractions, and it reasons upon phænomena divested of any connexion with matter: it observes and remembers what are the invariable points of analogy, and it rejects all others. Each step in knowledge enables it to diminish the number of apparent laws, and to discover that many effects at first sight dissimilar depend upon an identical cause.

It has accordingly been found that the greater our knowledge of facts, the simpler and more limited are found to be the laws to a knowledge of which they lead.

There is something exquisitely beautiful, highly pleasurable to the mind, in the approximations which are thus daily becoming evident, towards the determination of all phænomena into a dependence upon a very limited number of laws, or it may be upon a single one; a general physical law to which all effects whatsoever may be referred, of which those which we now regard as laws are only modifications, and into which they are all finally resoluble—a law potent through the boundless regions of space, unaffected by the lapse of time, and bearing the impress of its omnipotent and unchangeable Author. What a prospect of unity and simplicity does this unfold to the mind, what an evidence of power, what a pledge of continuance!

By the connexion then of the physical sciences is here meant the indications of uniformity, or it may be of identity, in the laws to which those sciences are subjected.

But there is a secondary and unavowed sense, in which the term "connexion" is employed in this volume—that of subserviency. Thus it is required to estimate the velocity of lightning, a problem in electrical science. To compass this, mechanics are brought into play, and a wheel, to which a mirror has been affixed, is made to whirl upon its axis. But it is necessary to count the number of revolutions performed by this wheel in a given time. To do this, a third science, acoustics, is called upon, and a peg fastened to the axis is made to strike a cord; and since each tone is known to be compounded of a definite number of vibrations, the velocity of the wheel is readily estimable. This cannot, however, justly be cited as a *connexion* between the sciences of electricity, mechanics, and acoustics, but only as an illustration, and a very beautiful one, of the degree in which one science may be made subservient to the acquisition of another, just as a knowledge of languages is of use in the acquisition of history.

But if it be shewn that the attraction of cohesion, by which materials are held together, mechanically, and the attraction of affinity, by which substances are held together, chemically, be dependent for their *power* upon the attraction of gravitation, and only modified in the application of it by other causes, then would a real connexion, amounting indeed to an identity, be shewn to exist between the sciences of Mechanics, Chemistry, and Astronomy. Botany and Zoology are sciences *subservient* to Geology; number and quantity are sciences *connected* with Astronomy.

Before the connexion between the physical sciences can be displayed, it is of course necessary to explain what those sciences are, and to what extent they have been cultivated. By this exposition therefore the bulk of the volume is occupied.

The science with which the volume opens, is, of course, Astronomy. But here the author has laboured under a difficulty, arising, perhaps necessarily, out of the nature of the work. Astronomy is too important a science to be disposed of satisfactorily in a few chapters; and its higher conclusions are too closely dependent upon its elementary steps, to admit of being fully comprehended without them. Sir John Herschel's treatise was complete, and therefore generally to be understood; but Mrs. Somerville has been obliged to confine herself to some of the higher parts of the science, which do indeed display the connexions of this with other sciences, but which require a previous acquaintance with the subject, more intimate than falls to the lot of ordinary readers.

But the astronomical sections of the work are nevertheless exceedingly interesting, and the views unfolded in them vast and infinite.

Thus it is shewn to be analogically probable, whilst the satellites are revolving round their primaries, these round the sun, and each is rotating upon its own axis, that the sun, the centre of our system, is himself, with all his revolving train, but a planet performing a wider revolution, around a mightier sun than he.

The section in which the perturbations, or variations, to which the system is liable, are explained, is peculiarly striking. Of these, one class depend upon the relative position of the orbs themselves, and being compensated in periods comparatively brief, from a few months to less than a thousand years, are called periodic variations; while the other class, the secular variations, depending not upon the position of the bodies themselves, but of the orbits in which they move, occupy periods of millions of years, and affect not only the forms and planes of the several orbits, but cause the great plane of the ecliptic itself to be in motion, and gradually to recede from its original place. But the science, to which we owe the knowledge of this tremendous fact, shews also that its extent is limited, and that although the limits are unknown of that great cycle which will extend into the immensity of time, yet that the very same cause to which these secular inequalities are due, will itself necessarily bring about their

compensation, when they shall have attained a certain fixed limit; a fact from whence La Place was enabled to draw a sure proof of the harmony and stability of the whole.

These irregularities, which are the necessary result of the general order which reigns throughout, and which shew the stability of the physical world, will be considered by the moralist as analogous to certain other irregularities, observed by him in the moral world.

The objection, such as it is, which may be thought to bear upon the astronomical part of this volume, does in no degree apply to the remainder, in which the other physical sciences are developed. Meteorology, Acoustics, Optics, the laws of Heat and its influence on life, Electricity ordinary and voltaic, Magnetism, and the various sciences with which it is so intimately connected, will be found clearly and concisely explained, and the present state and prospects of each, and the strong indications of uniformity in the cause, especially of many of the latter, set forth.

The whole of this portion of the volume is quite within the reach of any mind capable of attention, and cannot be understood without giving real pleasure.

Even to those whose minds, from want of education, are incapable of mathematical reasoning, or whose habits and dispositions do not lead them to earn the expansion of intellect with which the acquisition of any one abstruse science is accompanied, may nevertheless enjoy the grand and compendious view of human knowledge exhibited in this volume, they may ascend by this royal road, and behold traced out before them those regions where all is grace and beauty, correspondence and symmetry, the work of the greatest energy, directed by the highest wisdom.

"These formulæ," observes Mrs. Somerville, in conclusion, after enumerating the leading points of connexion between the sciences, daily becoming more closely united by the common bond of analysis,

> "These formulæ, emblematic of omniscience, condense into a few symbols the immutable laws of the universe. This mighty instrument of human power, itself originates in the primitive constitution of the human mind, and rests upon a few fundamental axioms, which have eternally existed in Him who implanted them in the breast of man, when he created him after his own image."

Recherches sur les Poissons Fossiles, par L. Agassiz, 4trième livraison, 1835. *(Rapport sur les Poissons Fossiles découverts depuis la publication de la troisième livraison.)*

In a former number of this Journal we mentioned the visit of M. Agassiz to this city, and the success with which his researches were rewarded; and we then proposed to ourselves to defer any lengthened notice of his system of classification until the whole of the above work should have appeared: that period has not yet arrived, but as the present fasciculus contains the report of M. Agassiz' labours in this country, we shall lay before our

readers the substance of its contents, which are indeed highly creditable to the zeal of the savans of Great Britain generally, and of this city in particular.

M. Agassiz, having already described and caused to be figured, almost six hundred species of fossil fish, and conceiving his work to be very far advanced, if not almost completed, determined to visit the museums of this country. He did so during the summer of 1834, and among their contents he discovered so many new species and genera, that it became evident that his labours, so far from being nearly completed, had in truth scarcely commenced. He discovered that there were vast geological tracts, containing fossil treasures hitherto unheard of, and that there existed many new specimens, from formations, with the fossils of which he had conceived himself to be perfectly acquainted.

The number of new species determined by M. Agassiz, during his visit to England, was about two hundred and fifty, from various localities and various geological formations, and more especially from those formations whose geological age being well determined in England, permitted them to furnish points of comparison with others on the Continent, thus confirming the appreciable relations between species of the same epoch, and testifying the justice of the general results previously announced by the author.

In enumerating the different sources, whence he derived his information, M. Agassiz mentions the Geological Society, and his observations are so just and pertinent that we shall translate them at length.

"The Geological Society of London is one of those institutions, which, established on the most liberal basis, favours by its influence every thing that can contribute, even indirectly, to the progress of science. To the liberal and enlarged views of the president and council of this body, I owe more particularly the having been able to achieve in London a work, which, without the support and countenance of so considerable a society, would have been impossible, and which stands without precedent in the history of the natural sciences. Finding scattered over the three kingdoms a prodigious quantity of new and important evidence for my work, I was embarassed how to select from it the most valuable portion: it appeared to me to be almost impossible, in small towns or retired parts of the country, to have the more important of the specimens I found there drawn sufficiently well, to enable me to have them recopied for the plates of my 'Researches.' But such is the liberality of scientific men in England, that all those whose collections I have examined, and even the directors of all the public museums that I have visited, (amounting, private and public, to sixty-three) have permitted me to remove every specimen that seemed likely to throw any new light upon fossil ichthyology. At the request of Professor Buckland, Mr. Greenough the now president of the Geological Society, and Messrs. Sedgewick, Murchison, and Lyall, have in addition procured for me the assent of the society to the reposition of all these treasures in a room at Somerset House. Mr. Lonsdale, the curator of the society's collection, has there aided me in arranging the two thousand specimens of fossil fish referred to, and that I had selected out of about five thousand specimens, whilst travelling over England and a part of Scotland and Ireland. Such a favour is invaluable, especially when the difficulty is borne in mind of transporting objects so fragile, and whose loss would be irreparable.

"If naturalists who carry on researches of this nature do not abuse these facilities, they will become in future more and more easily attainable, and thence will result real advantages to science. In my own case I have derived great advantage from having been enabled, by the direct comparison of the fragments scattered through many collections, to complete the character of many new species, and to prove the existence of a great number of others, many of which must have remained doubtful from the inspection only of very incomplete fragments. By this means I have been able to select for my drawings those specimens only which give the most exact idea, and to complete my descriptions from the whole. M. Dinkel, the artist by whom the greater number of the original plates of my "Researches on Fossil Fishes" were designed, is now in London, occupied in delineating all those specimens which have appeared to me indispensable for the completion of my work. When he shall have made some progress, I shall revisit London to compare his designs with their originals, before returning the latter to their owners."

In his way homeward from Ireland, M. Agassiz, as our readers are aware, visited Bristol; following his report, let us enumerate what he found here. His principal wish in visiting Bristol was to examine the fossils of the carboniferous limestone, a formation little known on the Continent, but from which he expected a good deal, judging from some specimens in M. Cuvier's collection, and some fragments which he had met with elsewhere.

"My expectations," he proceeds, "were not deceived. The museum of the Philosophical Institution contains the beautiful collection of its first curator, that indefatigable naturalist, Müller, and by consequence the originals whence were taken the plates of his work on the crinoidea. By the assiduous care of Mr. Stutchbury the present curator, and of Dr. Riley, the museum is daily increasing; it is more particularly remarkable for its magnificent collection of the fossils of Bristol and the neighbourhood. With respect to fishes, I found there many new species and even genera, from the carboniferous limestone, though only their teeth and the spinal rays of their dorsal fins; they belong to the family of the *cestraciontes*.

"I observed there also an immense number of fragments from a sort of osseous brecchia (bone bed) found among the inferior beds of the lias; among these fossils are many new species, and many which appear to me to be identical with those collected by Keuper and M. Alberti, in Wurtemburg. The other fishes of the lias possess large palates, provided with many ranges of teeth, like the *acrodus* and *hybodus* of Lyme Regis. There are also many *hybodontes* and *pycnodontes*, as well as *icthyodorulites*, from the great oolite, and from Stonesfield; and some teeth, palates of the rays, and some heads from Sheppy. The institution is indebted to Dr. Fox for a superb specimen of a new species of *tetragonolepis*, from the white lias of Banwell, and to Messrs. M. Wright and W. Clayfield, for beautiful specimens of *icthyodorulites*, from the lias and from the coal of Dudley. Mr. J. N. Sanders has reposited in the institution a fossil ray, certainly among the most important of the discoveries made in the lias of Lyme. Dr. Riley has very correctly described this animal under the term *squalo-raia*, and has assigned it its true place among the cartilaginous fishes. Mr. Grant, taking, after Dr. Riley's description, the prolongation of the snout for the jaws, has considered it rather to be a reptile; but the attentive examination that I have been permitted to make of it, has made me confident, that it is a particular genus of the ray family, different from any now existing. It is unfortunate that the name *squalo-raia* indicates an exaggerated affinity to the *squali*, it would perhaps be better to term it *spina corhinus*."

In the private collection of Dr. Riley, M. Agassiz observed some fine teeth from the chalk and from Sheppy.

In that of Mr. Cumberland, remarkably rich in fossil fishes, several new species were detected, from the lias of Lyme, from Bath, Hastings, the chalk, and from Sheppy. Among the latter were several palates of many ranges of teeth, constituting a new genus.

The fossils in Mr. Johnson's collection are also highly spoken of.

From Bristol M. Agassiz visited Lyme, whither however we have not space to follow him.

It should be added that the British Association has furthered M. Agassiz's views by placing a hundred guineas at his disposal, by the aid of which it is proposed to prepare plates of the new species discovered in England, which will then be described separately.

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*Statement of the Provision for the Poor, &c. in a considerable portion of America and Europe. By N. W. Senior, Esq.** London, 1835.

The following Table is abridged from the valuable Digest of Foreign Statistics, appended to Mr. Senior's recent publication on the Foreign Poor Laws. It illustrates in a decisive manner the comparative condition of the different countries enumerated, in respect to health, duration of life, progress of the population, &c. and in one important point, in respect to their morality also. A great variety of interesting conclusions might be drawn from the facts here brought forward; but they are introduced chiefly to remark how very satisfactory it would be to possess similar records, exhibiting the relative condition of different cities and districts in our own country. This can only be effected by the investigations of *local statistical societies*, and such an one it is trusted would find support and encouragement in this city, upon the statistics of which we possess but very meagre knowledge. In such an object the zealous co-operation of all classes and parties may be looked for, particularly of the parochial clergy, whose station enables them to afford most valuable assistance in statistical investigations; since accurate information is only to be procured by minute and multiplied inquiries *in every district.*

The following statistical table will afford to our fair readers more information than they might expect it to contain, as the third column shows, with some accuracy, the *chance of marriage* in different countries. It is evident, for instance, that, other things being equal, a lady has nearly twice as good a chance of finding a husband in *Hamburgh*, as she has at *Frankfort*, where the people appear not to live so fast, and the average duration of life is high. An examination of the table conveys also the gratifying conclusion to an Englishman, that in few respects does his own favoured country dread a comparison with any other, and that, statistically speaking, our condition is at least as favourable as that of any European state. Z.

* We have received this notice from a correspondent.—Edit.

STATISTICS.

1. The proportion of Annual *Deaths* to the whole Population?
2. ——— *Births* ———?
3. ——— *Marriages* ———?
4. The average number of Children to a Marriage ———?
5. Proportion of Legitimate to Illegitimate Births?
6. ——— Children dying before the end of their first year?
7. ——— ——— tenth year?
8. ——— ——— eighteenth year?

Country or Place.	*Proportion to the whole Population of Annual*			4. *Average No. of Children to a Marriage.*	5. *Proportion of Legitim to Illegitim. Births.*	*Proportion of Children that die before attaining their*		
	1. *Deaths.*	2. *Births.*	3. *Marriages.*			6. *First Year.*	7. *Tenth Year.*	8. *Eighteenth Year.*
England and Wales ..	1 in 49	1 in 28	1 in 128	4.41	19 to 1	1 in 5 2-35	1 in 2 3-5	1 in $2\frac{1}{3}$
Norway	1 in 54	1 in 28	1 in 119	.....	14 to 1	Under 5 yrs. 1 in 3	Under 10, 1 in 2 4-7	Under 20 yrs. 1 in $2\frac{3}{3}$
Sweden	1 in $41\frac{1}{2}$	1 in 29	1 in $117\frac{1}{2}$	3 6-10 to 4 1-6	16 to 1	Legit. 1 in 6 11-13 / Illegit. 1 in 3 15-17	13-29ths die before	their 16th year
Russia	1 in 25 92-100	1 in 23 36-100	1 in 132	.....	.....	.....	One half	.....
Denmark	1 in 40	1 in 34	1 in 123	3 27-40	9 6-10 to 1	.....	1 in $3\frac{1}{2}$	.....
Hamburgh.....	1 in 29	1 in 27	1 in $75\frac{1}{2}$	2 4-5	$4\frac{5}{8}$ to 1	1 in 6 1-5	1 in 3	1 in $2\frac{1}{2}$
Dantzig	1 in $24\frac{1}{2}$	1 in 29	1 in 134	.....	$6\frac{1}{2}$ to 1	1 in 5	1 in $2\frac{1}{2}$	1 in $2\frac{1}{3}$ (under 20)
Frankfort	1 in $43\frac{1}{2}$	1 in 48 1-5	1 in 188 7-10	5 to 6	6 7-10 to 1	1 in $6\frac{1}{2}$	1 in $4\frac{1}{4}$ (under 6 yrs.)	1 in $3\frac{1}{3}$ (under 19)
Saxony	1 in $34\frac{1}{2}$	1 in 24 8-10	1 in 131 8-10	.....	7 to 1	More than half	die under 14	.....
Wurtemburgh	1 in $31\frac{1}{3}$	1 in 27 1-10	1 in 147	4 3-10	7 1-10 to 1	34 2-3 in 100	Fr. 1 yr. to 7, 1 in 10	From 7 to 14, 1 in 45
North Holland.....	1 in 30 6-10	1 in 30 7-10	1 in 122 1-5	5 1-10	15 to 1	1 in 7 8-11	1 in 4 4-10	1 in $2\frac{3}{4}$
Belgium (Boom).....	1 in $28\frac{1}{2}$	1 in 36	1 in 95 1-5	.....	21 to 1	1 in 5	1 in 4	1 in 2 4-21
(Ostend)	1 in $35\frac{1}{2}$	1 in 31	1 in $146\frac{1}{2}$	4 72 100	9 to 1	1 in 5 7-10	1 in $2\frac{1}{2}$	45 per cent.
France (official return)	1 in $39\frac{1}{2}$	1 in $32\frac{1}{2}$	1 in $131\frac{1}{2}$	Legitim. 4 7-100 / Illegitim. 3 7-10	13 1-6 to 1	.....	.....	.....
Genoa.....	1 in 28 4-7	1 in 20	1 in 166	.....	.....	1 in 4	45 ℔ cent.	48 ℔ cent. before 16
AMERICA.								
New York.....	1 in 30	.....	.....	5	.....	27 ℔ cent.	49 per cent.	53 ℔ cent.
Catteagena (Columbia)	6 to 8 ℔ cent.	8 to 10 ℔ cent.	.....	4 to 5	5 to 6	One half	.....	.....
Hayti	Not known. Births &	Deaths suppod. equal.	Population stationary	3 to 4	1 to 1000	Large proportion	Large proportion	.....
Maranham.....	1 in 25	1 in 20	Comparativcly small	5	.....	.....	.....	.....

New and Complete Manual of Auscultation and Percussion. By M. A. Raciborski, M. D., etc. Translated by William Fitzherbert, B. A. 12*mo. pp.* 201.

This volume contains, within a sufficiently small compass, the substance of what has been advanced in favour of two very important methods both of medical and surgical diagnosis, auscultation and percussion, together with directions for the application of either. Auscultation, as our readers are possibly aware, is the recognition, by the aid of hearing, of the different noises which take place during the discharge of the functions of different organs, more particularly those of respiration and circulation.

Percussion, on the other hand, consists in shocks executed principally by means of the fingers at the surface of different regions of the body; returning of course different sounds, according to the different nature or state of the organs within.

Auscultation is therefore less generally practicable than percussion, being necessarily confined in its application to those organs that give rise to spontaneous noises. Where, however, it is applicable, its conclusions are more readily obtained, and in the hands of most men, more valuable, than those of percussion.

It would be unnecessary, even were this the proper place, to enter upon a discussion either of the relative or common advantages of these two methods of diagnosis; their great utility, and more especially that of the former, has already been amply proved, and they are appreciated and employed by those members of either branch of the profession whose education has led them to study at the schools of Paris: nor would any man, to whom the use of the stethoscope had become familiar, willingly restrict himself to the advantages of the old methods.

This is a very good manual; the facts brought forward in it are numerous, their arrangement clear, and the deductions for the most part acknowledged as sound, by the general testimony of experience. The original edition we have not seen; but Mr. Fitzherbert's translation appears to be well executed, and in form and cost it is convenient and reasonable.

LOCAL GEOLOGY.

We propose, with the view of making the local information contained in this Journal, as generally and as permanently useful as possible, to occupy from time to time, a portion of its pages with the descriptive Geology of a section of the Bristol district.

Under the term Geology, we shall include those subordinate sciences, a knowledge of which is essential to its pursuit; we shall attend to the chemical and mechanical structure and composition of the several rocks,

to the minerals, and above all, to the fossils contained within them; and we shall add such observations as we may be able to make, upon their œconomical uses, and the vegetation to which each gives nourishment.

With each portion of description will also be prepared, upon a scale of four inches to the mile, a map or plan of the section described, upon which the geological formations will be laid down in colours, and their dip, bearing, etc. indicated by proper marks. By this means our readers will gradually obtain a geological map of their district, upon a scale, and with an attention to detail, obviously inadmissible in a general map.

Specimens of the rocks, minerals, and fossils made mention of in each number, together with coloured field drawings of country, sections, etc. will be deposited in the geological apartment of the Institution, where they may be conveniently referred to by every one. References will also, in most cases, be found in the catalogue, to the exact spot from whence each specimen was obtained.

Although the basis of the description will be geological, attention will also be paid to the Hydrography of each district, and to its architectural and topographical antiquities; in short, it will be the rule of those by whom this plan may be carried into effect, to bestow attention upon whatever subjects may seem to them to deserve it.

When the maps and descriptions of the whole, or the greater part of any particular district, or geological formation, shall have been completed, a plate will be given of sections or profiles, in different directions, across the formation, instead of the usual map; and instead of the descriptive text, a general summary of what has been observed, with the plain and obvious inferences which such observations may indicate. This much is strictly due to the students in every inductive science.

Upon the merits of some such plan as the above there can be but one opinion; it is the peculiar province of local journals to collect local information; their supporters, resident for the most part upon the soil, possess opportunities for observation which a stranger cannot in any great degree obtain; and surely it is not too much to say, that they owe it to society to take advantage of such opportunities, provided always that their observation is not inconsistent with their severer duties. We shall be at all times obliged by sections of coal pits and workings of wells, draughts of local maps, lists of fossils, minerals, or plants of particular districts, together with any other local information.

For the convenience of those persons who may desire a second impression of each portion of the map, for the purpose of mounting, a number of extra impressions will be held on sale by the publishers; but these can in future only be issued to those persons who shall give notice of their wishes at least two months before the publication of each number.

We shall commence in January with the parish of Portishead.

1835. APRIL.		HIGH WATER. TIME. h.	m.	HEIGHT. ft.	in.	LOW WATER. TIME. h.	m.	HEIGHT. ft.	in.	WIND.	LUNATIONS. h.	m.
1	A. M.	8	45	38	0							
	P. M.	8	50	37	2	..		..		S.		
2	A. M.	9	5	36	8							
	P. M.	9	15	36	0	..		..		Variable.		
3	A. M.	9	32	35	3							
	P. M.	9	47	34	3	..		..		S. W.		
4	A. M.	10	0	32	8	4	8	4	0			
	P. M.	10	5	31	8	4	20	4	1	S. W.		
5	A. M.	10	30	29	9	4	20	5	0			
	P. M.	10	45	28	8	4	25	5	6	S. W.		
6	A. M.	11	5	26	8	4	42	6	6			
	P. M.	11	15	25	11	5	5	7	4	S.	☽	9 31
7	A. M.					5	15	9	1			
	P. M.	0	15	24	6	6	15	10	2	S.		
8	A. M.	1	10	25	3	7	25	10	0			
	P. M.	2	30	26	6	8	38	8	6	S. W.		
9	A. M.	3	0	28	9	9	10	6	7			
	P. M.	3	38	31	1	10	15	4	7	S. W.		
10	A. M.	4	0	32	9	10	25	4	0			
	P. M.	4	45	34	9					N. W.		
11	A. M.	5	0	36	4	..		..				
	P. M.	5	20	38	0					N.		
12	A. M.	5	45	39	3	..		..				
	P. M.	6	15	40	6					Variable.		
13	A. M.	6	28	41	8	..		..				
	P. M.	7	50	42	0					S. W.	○	7 16
14	A. M.	8	10	42	7	..		..				
	P. M.	8	30	42	8					W.		
15	A. M.	8	38	42	10	..		..				
	P. M.	9	0	41	8					Variable.		
16	A. M.	9	20	40	10	..		..				
	P. M.	9	30	39	9					Variable.		
17	A. M.	10	0	38	10	..		..				
	P. M.	10	20	37	4					N.		
18	A. M.	10	35	36	3	..		..				
	P. M.	10	45	34	6					N. W.		
19	A. M.	11	10	32	10	..		..				
	P. M.	11	30	30	9	5	25	4	7	Variable.	☾	11 13
20	A. M.					5	35	4	10			
	P. M.	0	10	29	9	6	22	7	0	W.		
21	A. M.	0	50	28	6	7	15	7	0			
	P. M.	1	42	27	10	7	50	8	7	W.		
22	A. M.	2	32	29	4	9	13	6	0			
	P. M.	3	30	29	8	9	44	6	0	N.		
23	A. M.	3	44	31	8							
	P. M.	4	19	32	6	..		..		N.		
24	A. M.	4	50	35	3							
	P. M.	5	26	36	6	..		..		N.		
25	A. M.	5	54	38	2							
	P. M.	6	8	38	9	..		..		N. W.		
26	A. M.	6	28	39	5							
	P. M.	6	49	39	10	..		..		N.		
27	A. M.	7	0	40	8							
	P. M.	7	15	40	8	..		..		Variable.	●	9 20
28	A. M.	7	30	40	8							
	P. M.	7	45	40	7	..		..		N. E.		
29	A. M.	7	55	40	3							
	P. M.	8	5	38	6	..		..		N. E.		
30	A. M.	8	30	40	0							
	P. M.	8	40	40	3	..		..		N. E.		

1835. MAY.		HIGH WATER. TIME. h.	m.	HEIGHT. ft.	in.	LOW WATER. TIME. h.	m.	HEIGHT. ft.	in.	WIND.	LUNATIONS. h.	m.
1	A. M.	8	50	39	10							
	P. M.	9	0	39	5	..		..		Variable.		
2	A. M.	9	25	38	8							
	P. M.	9	40	38	1	..		..		W.		
3	A. M.	10	15	36	8							
	P. M.	10	30	36	0	..		..		W.		
4	A. M.	10	50	34	5							
	P. M.	10	40	33	8	4	58	9	1	W.		
5	A. M.	10	55	32	4	5	5	9	9			
	P. M.	11	5	32	3	5	20	11	6	S. W.	☽ 10	43
6	A. M.	12	0	31	3	6	7	12	6			
	P. M.					6	40	13	5	S. W.		
7	A. M.	0	30	31	6	7	23	12	3			
	P. M.	1	33	32	3	8	10	11	5	W.		
8	A. M.	2	28	33	6	9	19	9	6			
	P. M.	3	15	34	10	10	0	8	0	S. W.		
9	A. M.	3	55	36	8	..		..				
	P. M.	4	6	38	7					S.		
10	A. M.	4	37	40	0	..		..				
	P. M.	5	17	41	9					W.		
11	A. M.	5	38	42	4	..		..				
	P. M.	6	25	43	6					W.		
12	A. M.	6	40	43	10	..		..				
	P. M.	6	50	44	9					S. W.	○ 3	14
13	A. M.	7	5	45	3	..		..				
	P. M.	7	25	46	0					W.		
14	A. M.	7	45	45	6	..		..				
	P. M.	8	0	48	10					S. W.		
15	A. M.	8	30	44	0	..		..				
	P. M.	8	45	43	2					S. W.		
16	A. M.	9	0	42	0	..		..				
	P. M.	9	15	40	9					S. W.		
17	A. M.	9	42	39	2	..		..				
	P. M.									S.		
18	A. M.					..		..				
	P. M.	11	30	35	2	5	20	7	11	S.		
19	A. M.					6	10	8	2			
	P. M.	0	11	33	7	6	17	10	0	Variable.	☾ 10	39
20	A. M.	0	45	33	4	7	13	9	2			
	P. M.	1	18	31	11	7	24	11	0	Variable.		
21	A. M.	2	9	33	2	8	15	9	2			
	P. M.	2	20	32	4	8	51	10	3	N. E.		
22	A. M.	2	56	34	8	9	42	8	7			
	P. M.	3	25	34	6	10	6	8	6	W.		
23	A. M.	3	48	36	2	10	48	7	6			
	P. M.	4	8	36	4					S. W.		
24	A. M.	4	34	37	2	..		..				
	P. M.	5	9	37	9					S. W.		
25	A. M.	5	35	38	9	..		..				
	P. M.	5	40	39	3					S. W.		
26	A. M.	5	50	39	8	..		..				
	P. M.	6	5	40	5					W.		
27	A. M.	6	32	40	3	..		..				
	P. M.	6	48	40	3					Variable.	● 1	32
28	A. M.	7	12	39	10	..		..				
	P. M.	7	18	39	11					Variable.		
29	A. M.	7	43	39	4	..		..				
	P. M.	7	55	39	4					N. E.		
30	A. M.	8	4	38	10	..		..				
	P. M.	8	14	38	10					N. E.		
31	A. M.	8	34	38	6	..		..				
	P. M.	8	40	38	4					S. W.		

1835. JUNE.		HIGH WATER. TIME. h.	m.	HEIGHT. ft.	in.	LOW WATER. TIME. h.	m.	HEIGHT. ft.	in.	WIND.	LUNATIONS. h.	m.
1	A. M.											
	P. M.	9	50	30	7	..		..		Variable.		
2	A. M.	10	15	29	6							
	P. M.	10	25	29	5	5	0	1	10	S. E.		
3	A. M.	11	0	28	7	5	8	2	4			
	P. M.	11	15	28	6	5	20	3	2	S.		
4	A. M.					6	10	3	1			
	P. M.	0	5	27	2	6	30	3	6	N. E.	☽ 8	6
5	A. M.	0	45	28	4	7	30	3	0			
	P. M.	1	40	27	6	8	7	3	0	N. E.		
6	A. M.	2	0	28	11	9	0	2	6			
	P. M.	2	40	29	9	9	30	1	11	N. E.		
7	A. M.	2	53	31	3	10	10	1	6			
	P. M.	3	30	32	0					Variable.		
8	A. M.	3	50	33	2							
	P. M.	4	30	34	3	..		..		Variable.		
9	A. M.	4	50	35	0							
	P. M.	5	30	36	2	..		..		W.		
10	A. M.	5	40	36	4							
	P. M.	6	0	37	2	..		..		W.	○ 10	46
11	A. M.	6	15	37	1							
	P. M.	6	43	37	9	..		..		W.		
12	A. M.	7	20	37	0							
	P. M.	7	40	37	1	..		..		N.		
13	A. M.	8	10	36	4							
	P. M.	8	17	36	4	..		..		N. E.		
14	A. M.	8	35	35	4							
	P. M.	9	0	35	1	..		..		N. E.		
15	A. M.	10	10	33	5							
	P. M.	10	45	33	1	..		..		Variable.		
16	A. M.	11	0	31	9							
	P. M.	11	20	31	3	..		..		Variable.		
17	A. M.	11	45	29	9	6	0	1	4			
	P. M.					6	15	2	6	S. W.		
18	A. M.	0	25	29	7	6	30	2	6			
	P. M.	0	30	28	3	6	48	3	8	N. E.	☾ 0	6
19	A. M.	1	0	28	6	7	30	3	1			
	P. M.	1	30	27	5	7	35	5	0	Variable.		
20	A. M.	2	10	28	0	8	40	3	6			
	P. M.	2	35	26	7	9	5	4	5	W.		
21	A. M.	3	0	27	9	9	35	2	3			
	P. M.	3	26	27	2	10	0	2	4	W.		
22	A. M.	3	57	27	4	11	15	2	10			
	P. M.	5	10	29	9	11	40	3	4	W.		
23	A. M.	5	15	29	8							
	P. M.	5	30	31	0	..		..		W.		
24	A. M.	5	45	31	4							
	P. M.	5	52	31	9	..		..		Variable.		
25	A. M.	6	23	31	10							
	P. M.	6	45	32	3	..		..		N. W.		
26	A. M.	7	0	33	4							
	P. M.	7	0	34	6	..		..		S. W.	● 4	21
27	A. M.	7	30	33	10							
	P. M.	7	53	34	7	..		..		N. W.		
28	A. M.	8	24	33	9							
	P. M.	8	30	34	4	..		..		Variable.		
29	A. M.	8	50	33	2							
	P. M.	9	10	33	6	..		..		Variable.		
30	A. M.	9	25	32	9							
	P. M.	9	40	32	9	..		..		S. E.		

METEOROLOGICAL TABLE,

For the months of JULY, AUGUST, *and* SEPTEMBER, 1835, *kept on Nine-tree Hill, Kingsdown, Bristol.*

July	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·88	75	56	0·03	S. E.	Fine Light.&Rain P.M.
2	·89	77	57		S. W.	Fine
3	·95	75	55		W.	Ditto
4	·92	74	57	0·17	S. W.	Ditto. Rain at night
5	·68	72	51	0·30	S. W.	Rain
6	·94	73	47		S. W.	Fine
7	30·02	75	50	0·05	S. W.	Ditto. Rain at night
8	29·85	74	57		S. W.	Fine
9	·78	76	53	0·18	S. W.	Cloudy. Rain, P.M.
10	·70	71	49		S. W.	Fine
11	·94	73	53		S. W.	Ditto
12	·82	71	54	0·12	S. W.	Ditto. Rain at night
13	·73	73	48	0·02	W.	Changeable
14	·91	73	53		W.	Fine
15	·73	72	48	0·06	S.	Cloudy. Rain at night
16	·78	72	53		S. W.	Fine
17	·84	77	60		S.	Ditto
18	·80	79	52	0·01	S. W.	Drizzling
19	·96	77	60		S. W.	Fine
20	·97	80	58		S. W.	Ditto
21	30·03	81	59		N. E.	Ditto
22	·03	78	57		N. E.	Ditto
23	·04	79	56		E.	Ditto
24	·01	80	61		E.	Ditto
25	29·99	79	56		E.	Ditto
26	·95	80	52		E.	Ditto
27	·90	82	58		Vrble.	Ditto
28	·93	82	57		W.	Ditto
29	30·07	77	55		N. E.	Ditto
30	·04	78	55		Vrble.	Ditto
31	·01	72	49		N. E.	Ditto

Aug	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·97	75	58		Vrble.	Fine
2	·80	79	53	0·59	Vrble.	Chan. Thun. & Light.
3	·87	72	52		N. E.	Fine
4	·89	73	58		N. E.	Ditto
5	·87	78	58	0·08	S. W.	Cloudy. Rain at night
6	·90	75	64		W.	Cloudy
7	·85	78	47		N.	Ditto
8	30·13	68	48		N.	Fine
9	·20	75	55		N.	Ditto
10	·13	78	63		S.	Ditto
11	29·87	84	64		S.	Ditto
12	·82	81	53		W.	Ditto
13	·96	69	49		N. W.	Ditto
14	30·06	74	51		N. E.	Ditto
15	·04	77	63		W.	Ditto
16	·03	77	65		W.	Ditto
17	·10	80	61		N.	Ditto
18	·11	76	54		N. E.	Ditto
19	·04	77	58		N. E.	Ditto
20	29·77	80	59		Vrble.	Ditto. Thunder, P.M.
21	·48	80	61	0·13	S.	Fine, A.M. Thund. P.M.
22	·40	74	56	0·02	S. W.	Changeable
23	·55	75	60	0·75	S. W.	Ditto
24	·39	72	56	1·20	S. W.	Rain, with Thun. &c.
25	·53	59	47	0·09	N. W.	Rain
26	·59	64	53	0·05	N. W.	Drizzling Rain
27	·59	69	49		N. E.	Fine
28	.86	71	49		E.	Ditto
29	·91	69	51	0·04	N. E.	Fair. Rain at night
30	·89	73	51		E.	Fine
31	·91	70	49		E.	Ditto

Sep.	Baro. 9 A. M.	Thermom. Max.	Thermom. Min.	Pluvio-meter.	Wind.	Weather.
1	29·96	71	49		E.	Fine
2	30·05	71	50		E.	Ditto
3	29·90	74	60		S. E.	Ditto
4	·69	75	58	0·10	S. W.	Ditto. Light Rain, P.M.
5	·78	74	54		W.	Fine
6	·94	74	55		N. E.	Ditto
7	·90	55	52	0·01	E.	Ditto, with Thunder
8	·57	67	46	0·30	S. W.	Rain, A.M. Fine, P.M.
9	·64	63	52	0·18	W.	Changeable
10	·23	65	51	0·28	W.	Stormy
11	·47	61	51	0·13	W.	Fair. Rain at Night
12	·20	64	49	0·15	W.	Chan. with Thunder
13	·42	65	49	0·02	N. W.	Fair. Rain, A. M.
14	·68	70	58	0·03	S. W.	Cloudy. Light Rain
15	·64	70	48	0·22	S. W.	Rain
16	·63	64	46	0·25	S. W.	Changeable
17	·56	64	42	0·01	S. W.	Fair. Light Rain
18	·62	61	53	0·42	S.	Rain
19	·38	69	54	0·02	S. W.	Cloudy. Drizzling
20	·44	65	50	0·52	S. W.	Stormy
21	·66	65	53	0·10	Vrble.	Cloudy. Rain, P.M.
22	·28	67	53	0·18	S.	Ditto Ditto
23	·43	66	53	0·04	S.	Changeable
24	·68	64	41		S.	Fair
25	·83	60	45	0·14	S.	Fine. Rain at night
26	·49	65	40	0·01	W.	Cloudy. Lt. Rain, A.M.
27	·45	62	44	0·28	S. W.	Fine. Rain at night
28	·37	55	45		S. W.	Fine
29	·42	63	54	0·17	S.	Ditto. Stormy at night
30	28·92	64	47	0·12	S. E.	Chan. Stormy, A.M.

The mode of taking the observations is as follows:—The Barometer (with an open cistern) is noted every morning at nine o'clock, and its height placed opposite to the day of the month; but the Thermometer and Pluviometer, which are also examined at the same time, have their results recorded opposite to the date of the day preceding, consequently they apply to a period of twenty-four hours, beginning at nine, A. M. on the day indicated. The Wind is noted by observations on the highest and best vanes of the churches in the city; and when more than one direction is observed during the day, the word Variable is used. The Weather noted is the general character of the day.

Small Street, Bristol.

EDWARD JONES.

A GEOLOGICAL MAP OF PORTISHEAD 1836.

20 Chains

Scale

Supposed Anticlinal

Battery

C.L.

N.R.S.

C L.

O.R.

N.R.S.

Dyrham

Cattle Droves

Woodhill Bay

Black Nore

D.C.

Blackley House

Coal Seam

R.M.

Old Sea Bank

Mill

Marsh

Downgate Farm

D.Y.

Capenor Court

B

O R

Portishead Down

F.

Shale

C.L.

N.R.S.

Probable Line of Fault

E Section

A Sea D.C Dolom. Congl. Old Red Carb. Limest. D.C Fault O.R. C.L. D.C. Marsh B

E O.R. Shale C.L. N.R.S. Marsh F

N.R.S. Pennant, New Red S. C.L. A.R.S. Lias, Inf. Pennant

G.T.C.

N. Baker lithog

WEST OF ENGLAND JOURNAL

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PART I.—SCIENCE.

A GEOLOGICAL DESCRIPTION OF THE PARISH OF PORTISHEAD.

The district, with the descriptive Geology of which we propose to occupy a part of the present number, includes four square miles of country, extending from Portishead point to Blacknore on the north, and from a little to the north of Weston and Clapton in Gordano on the south; a tract, the greater part of which is contained within the parish of Portishead, and the whole of it within the hundred of Portbury.

The north-western half of this district consists of a central down, whence a series of tabular hills, more or less connected, pass off gradually to terminate on the sea in a low cliff; while on the land side they sink down more abruptly into a slightly elevated platform, which is in its turn lost in an alluvial marsh.

On the north, the point of Portishead consists of a steep ridge towards the sea; and a rounded hill towards the land, or south side. These hills form a sort of peninsula, being separated from the land on the west by Woodhill Bay, and on the east by the pill or creek of Portishead.

The water courses of this district present nothing very worthy of remark. The principal brook, a nameless one, after draining the moor and the southern declivities of the hills, falls into the pill of Portishead. The drainage of the northern side is not carried on by any single channel, but a number of small streams find their way into the sea at various distances along the coast.

The character of the shore, west of the pill, is rocky, with occasional shingle beds, and a few patches of sand, almost surrounded by the muddy deposits of the Severn. The cliff varies in height, from twenty to forty or fifty feet, and is for the most part rugged and picturesque. For some yards west of the point the cliff is wanting, and its place is supplied by a thick bed of shingle.

The water off shore increases in depth very rapidly.

There is but little fine timber in this district, which appears to have been much neglected until of late, since the few trees that have been planted have thriven well; and the sides and summits even of the most exposed elevations, are very thickly covered with copse wood and verdure.

The circumstances under which this number of the Journal appears, prevent our entering, as we had intended, into the archæological details of the district, so that we can only observe that, although the sides of some of the hills are scarped into linchetts or terraces, so regular as almost to appear to be artificial, yet that no decidedly authentic earthworks were remarked, nor any similar traces of an early population.

The church is, as usual in these counties, perpendicular; but its east window has a marigold head. The general style of the building is extremely good, and its decorations sufficiently rich. A vestry, or similar building, has lately been added to it; and, strange to say, in remarkably good taste.

There are two ancient houses in the parish; one, with a singular polygonal turret, adjoining the church-yard; and another, called Capenor Court, a part of which has tumbled down, and the rest seems likely to follow shortly. These houses appear to be of the date of James or Elizabeth, or perhaps a few years later.

There are some remarkably fine elm trees in the paddock, at Capenor.

The geological formations of this district, like those throughout the Bristol coal field generally, are of two distinct classes, arranged for the most part in different planes. The inferior, or carboniferous rocks, approaching more or less nearly to the vertical, the superior, or rocks of the new red sandstone series, to the horizontal plane; both, however, being subject to occasional variation.

I. And first of the carboniferous rocks, which are of three kinds:—1. the old red sandstone, the lowest member of the series; 2. the carboniferous or mountain limestone, the next member; 3. the pennant or grit of the coal basin, the uppermost here observed.

1. The old red sandstone forms the nucleus upon which the upper carboniferous rocks repose conformably, and from which therefore they dip: it is known to contain a few fossils, but these are extremely rare, and were not observed here. Hills composed of it are known from their flat tops, rounded outline, the quantity of debris with which they are masked, and the copious springs of water to which they give rise.

2. The carboniferous limestone reposing, for the most part conformably, upon the old red, is separated from it by a thick bed of shale, which, being readily acted upon by water, is usually wrought into a valley, which therefore characterises the junction of the above two rocks. This rock is abundantly fossiliferous, and, besides other fossils, is chiefly remarkable for various genera of the family crinoidea,* producti, and spirifera. Though so

* Cyathocrinites, actinocrinites, rhodocrinites.

damp as to be unfit for building, this rock does not give origin to springs, but, on the contrary, often engulfs them, when they flow upon it from the old red.

3. The pennant is usually separated from the carboniferous limestone by a considerable thickness of millstone, or Brandon Hill, grit and quartz conglomerate. These rocks are, however, almost if not altogether wanting in this district, in which the pennant lies immediately upon the limestone. The pennant is a sandstone more or less fissile, and varying in appearance; it contains a great variety of fossils, chiefly tropical plants, and it passes gradually into the rocks containing the coal, or coal measures.

II. The new red sandstone formation is composed of three members :— 1. the dolomitic or magnesian conglomerate; 2. the new red sandstone; 3. upon the summit, the red marl.

1. The dolomitic conglomerate is composed of pebbles from various older rocks, cemented by a magnesian paste. These pebbles vary according to the structure of the rocks upon which the conglomerate rests, and are in quantity also extremely irregular. Sometimes there are no pebbles; and, as on the coast of Sully, the rock is perfectly homogeneous. Such a rock, if its origin be considered, is not likely to contain many very perfect fossils. At Portishead it contains a few crinoidal vertebræ, but even these are rare.

2. The new red sandstone, overlying the conglomerate, is in its appearance extremely variable; it is usually of a deep red hue, whence its name; but at Portishead, it is of a fine bright buff colour. It contains scarcely any fossils, and those only in minute portions.

3. The red marl, degrading into a red soil, forms the upper member of the series, and is often of great thickness. At Portishead it is only observed in a very minute quantity; it contains chrystals of strontian and other minerals, but no fossils.

Such being the general characters of the rocks found in the district we have selected on the present occasion, we shall now proceed with the details of our description to some minuteness, and then enumerate the principal facts observed, and the inferences obviously deducible from them.

The mill at the head of the creek stands upon alluvion and made ground, but the red marl is seen in the bank of the road just west of it. Ascending the hill through the new lodge, is the new red sandstone, not very well seen; but higher up, the hill is masked with the debris of old red sandstone of a thickness of eight or ten feet; and towards the summit the rock itself appears, and is quarried extensively. It there dips 17°, and bears E. by N. true bearing.

These beds are highly micaceous, fissile, abounding in indurated clay nodules, and contain a very few quartz pebbles. The mica has a green tinge. The beds vary from one to ten feet in thickness, and are quarried for flags and building stone. The quarry is also employed as a stone-mason's yard for dressing Welsh flags and other stone. The new houses west of

the quarry stand upon old red, which however ceases a few yards beyond them.

Following the road to the first fork, at which the old red is obscurely seen forming the hill, the road to the battery crosses a valley of dolomite, not however there exposed. Where the road reaches the opposite hill, at its turn, a fine section of the carboniferous limestone is seen. The beds exposed are the lowest above the shale, and have been exceedingly disturbed; so much so, that a very complete, though local, anticlinal line is observed. By following the road to the west end of the hill, up to the point at which it is intersected by a footpath, the general dip will be found at 70°, and bearing about N. by E. These beds are for the most part thin, much shattered, and interstratified with shale, resembling the lower beds of the same rock elsewhere. They contain few perfect fossils, but chiefly fragments of crinoidea and producti. They are of a green, red, and in some cases of a buff colour.

Just beyond the footpath the carboniferous limestone disappears, being covered up by the dolomitic conglomerate, and some beds of new red sandstone.

Retracing our steps to the fork, if we take the road towards the hotel, we shall observe, a few yards on, a section of the dolomite, covering up the skirts of the old red hill, all the way to the second fork, where these roads join. If we take that on the *right*, a new one, we shall cross a field of red dolomitic conglomerate; and on arriving at the cutting, where the road crosses the tail of the hill, we shall observe the dolomitic conglomerate covering up the skirts of the lowest beds of the carboniferous limestone shale, which are there seen to rest upon the old red. These limestone beds dip in a radiated manner from the hill as a nucleus, being, no doubt, thrown out by the old red, which makes its final easterly appearance at this place.

The beds of the old red are thin and comminuted; their dip is not very evident, but appears to be N. N. E. As the road proceeds and descends the hill, the old red ceases, and is covered up by the horizontal rocks. The whole of this end of the hill is covered over with a thick mask of debris, composed of angular fragments of old red, imbedded in a very large proportion of a red sandy soil.

Retracing our steps to the second fork, if we take the road up the hill to the left, we shall observe a quarry of carboniferous limestone, just emerging from beneath the dolomite. This section exactly corresponds to the section at the other end of the hill, and shews the local anticlinal, here seen to be only local, and the general contortions of the strata very well. The dip here varies from eighty to vertical, and the bearing is N. by E.

Some of the beds in this quarry are very thick, and contain producti; they present fine specimens for polishing. This road, if followed, leads to the summit of the ridge, which is of carboniferous limestone.

Returning to the second fork, and taking the middle road towards the

hotel, we shall see a section of dolomitic conglomerate almost immediately on the left. A little further on, the carboniferous limestone is thrust forwards, but speedily retires, and continues to be covered up by the dolomitic conglomerate all the way to the hotel. The rock is much overgrown, but occasional sections are afforded, at which its horizontal stratification is visible. Near the hotel is a small half-concealed quarry, in which the rock is remarkably well seen, and from whence—a rare occurrence—specimens of cyathocrinites and producti, and chrystals of sulphate of strontian may be procured. All along this road the dolomitic conglomerate is covered up with a mask of carboniferous limestone debris, composed of a number of minute angular fragments, closely packed together with the intervention of very little soil, therein forming a strong contrast to the debris of the old red.

If, leaving the hotel, we turn the ridge, and follow the road that runs along its seaward side, we shall have a section of the carboniferous limestone until nearly opposite the baths; from thence the dolomite extends to the footpath at which it has been previously mentioned as visible. The bow of road leading down to the bath house, affords a good section of the horizontal rock.

If, from the hotel, we descend the stairs of the landing place, and take a glance to the right, up the pill, we shall observe the cliff to be formed of dolomite, and the beach of highly-inclined pennant, dipping from 60° to 70°, to the S. S. W.; and, if we traced this pennant up the pill, we should find it to be gradually covered up by dolomite and alluvial mud, although a successful trial for coal a little to the north of the mill demonstrates its continuance.

Descending the landing place at low water, if we step upon the beach on the left, a very striking series of phænomena will present themselves.

The landing place itself will be seen to be composed of a strip of dolomite, or rather of new red sandstone, overlying the pennant, and containing barytes, sporadic lead ore, and a good deal of calcareous spar, but no perceptible fossils.

The cliff here becomes much more lofty, and with the beach is composed of pennant, dipping and bearing as before. Not many yards north of the landing place is a bed of pennant shale, about twenty feet thick, beyond which is an anticlinal line, very well marked, and about which the beds are nearly vertical. The beds there begin to dip in an exactly contrary direction.

The pennant, dipping 63°, and bearing E. N. E. extends beyond the steps leading from the garden nearly to the western end of the little bay. At the steps are some fine impressions of calamites, and of some plants of the genus sigillaria; and scattered about are very large masses of hæmatitic iron ore.

Upon the beach are a few outlying blocks of new red sandstone, evidently in situ, since they fit exactly into the interstices of the pennant; although,

being soft, a specimen of their junction is not readily to be removed. In this bay the hæmatite crops out in a large vein.

The pebbles at the eastern end of the bay are sandstone, old and new; a few quartzose and others washed out of the dolomite, and a very few of lias. At the point forming the western extremity of the bay, the new red forms the cliff; and, with the occasional reappearance of the pennant, continues to form both cliff and beach nearly to the battery.

The new red, or rather the dolomite, for they pass imperceptibly into each other, is here of a light buff colour, in some places so friable as to be scraped for sand, and in others sufficiently compact to form a very excellent building stone. It contains very few fossils; three connected joints of an encrinite were the only result of a whole day's research.

A measurement of the face of the cliff, a little to the east of the bath house, gives six feet of supersoil, three of buff-coloured sandstone, six of marly beds, and twenty of yellow sandy dolomite, reposing on the basset edges of the pennant. In some parts a deep red bed comes into view, being the lowest here deposited. The platform upon which the battery has been thrown up is formed of new red sandstone, connected with that just described; it overlies beds of carboniferous limestone, dipping at about 70° N. by E. but in parts singularly contorted.

In external character these beds more nearly resemble red dolomitic paste, than the regular carboniferous limestone, but they contain vast quantities of crinoidea and producti; and of the former, the stems of the cyathocrinites are remarkably well seen.

The inclined beds cease abruptly, and the beach is formed for some distance westward by beds exactly similar, but disposed horizontally or nearly so, with occasional abrupt undulations. They there terminate suddenly in a high shingle bank of old red pebbles, defending a small triangle of alluvial flat from the sea, and continuing topped by the embankment for a new road, until, towards the middle of Woodhill Bay, the old red appears in situ, dipping 20°, at about S. E.

The old red continues to appear throughout the north-western part of the district, as the fundamental rock. It forms the cliff at Blacknore point, in which a series of marl beds, twenty feet in thickness, are seen; and above them a bed of quartz conglomerate, which passes off above by degrees into the regular homogeneous old red. This is an excellent place for specimens of the old red and its conglomerate.

Further on, the old red forms only the basis of the cliff and the greater part of the beach; the former being capped by dolomitic conglomerate, blocks of which, some of them apparently in situ, lie scattered along the shore. The pebbles of this conglomerate are generally derived in the greatest proportion from the subjacent rock, and here it is full of quartz and old red pebbles. The cementing paste is white and dense, though abounding in cavities: it presents a very few broken crinoidal stems.

If, leaving the beach, we ascend the hill, we shall see, from the configuration of the ground, the extent of the patches of dolomitic conglomerate. The whole of the hill is composed of old red, which, with a tolerably uniform dip and bearing, extends from the western margin of the alluvial triangle, up the hill towards Down Gate Farm, a little to the east of the road, along which it is quarried, and forms the summit and all but the south-eastern crest of Portishead Down.

We have thus described the north-western half of the district; let us next consider that to the south-east.

Ascending from the head of the pill in a westerly direction, by either of the two roads, we shall find ourselves for a short space upon the red marl. Higher up the hill, but underlying the red marl, comes in the dolomite, of which the edge and part of the hill is formed. Beyond this the carboniferous limestone appears in a thin band, behind which is the old red sandstone. If we then walk in the direction of the Down Gate Farm, keeping considerably to the east of the road which has been seen to run upon the old red, we shall be able to trace out the thin band of carboniferous limestone, reposing to the north-west upon the old red, and supporting in the contrary direction a buff-coloured dolomitic paste, here slightly inclined from the carboniferous limestone. These points it is difficult to establish fully in the fields; but on arriving at the road between the Down Gate Farm and the church, a slight section, which we shall now follow, comes to our assistance. The Down Gate Farm stands upon the upper beds of the old red, which a little to the east of it become highly calcareous, and are well seen passing into carboniferous limestone, in a small quarry near the gate at the head of the lane. This section deserves particular attention, since, besides these intermediate beds, there is found above them a bed of quartz conglomerate, concerning which it is difficult to decide whether it be only a detached bed of the old red, or the representation of the millstone grit. In geological and mineralogical characters it will answer to either; but in the latter case, it must be observed that the bed of limestone is unusually thin. At the Point, moreover, the millstone grit is altogether wanting; the pennant reposing immediately on the carboniferous limestone.

Following the road towards the church, the carboniferous limestone gradually disappears, and in its place are seen the beds of the dolomitic conglomerate, and new red, dipping at a slight inclination, but in a direction conformable with the limestone beneath. As we proceed along the road, the former beds sink, and those superior to them come into view, until, just before the road bifurcates, traces of the red marl appear. At the bifurcation, these rocks become very nearly vertical, dipping slightly *to* the carboniferous limestone, and then they suddenly cease, and beds of old red come into view. These beds are extremely thin, much comminuted, and as nearly vertical as possible; and, to judge from the appearance at the junction, it seems as though a sudden change had occurred in the relative level of the

two rocks, bringing the old red again into view, and turning up the edges of the horizontal strata. On descending the road towards the church, the old red exhibits itself under a more decided character, and lies in thick beds, whose dip and bearing however it was not found practicable satisfactorily to estimate.

Near the bottom of the lane, just above the highest cottage, is a bed of quartz conglomerate, not dissimilar in appearance to that described as cropping out in the cliff at Woodhill bay.

The old red does not extend very far on either side of the lane, being exchanged on the north for the horizontal rocks, and supporting on the south the carboniferous limestone. At the bottom of the lane it is covered up with dolomitic conglomerate, which extends a little to the east of the Portishead and Weston in Gordano road, between which and the marsh its lower boundary extends beyond the limits of the present district.

If, at the last-described bifurcation, we had taken the road to the right, we should have observed the old red, covered up with an occasional patch of dolomite, to extend down the road nearly to Capenor Court, terminating abruptly towards the west in dolomite; and towards the east underlying the carboniferous limestone. Below Capenor Court the carboniferous limestone is very well seen, dipping 20° E. N. E. and forming the steep and rocky hill between Capenor and the church, the skirt of which is covered up, as usual, by dolomite. It should be observed, that the carboniferous limestone of this hill is of a buff colour, and differs in appearance, though not in fossils, from the ordinary rock; but that it closely resembles the beds at the battery. Leaving Capenor Court by the road to the south, we shall observe the dolomite about us; and on striking off towards the top of Portishead Down, across the fields, we shall find the dolomite to form the spur of the down above us, and to ascend for some way up a small comb, above which an occupation road leads to the down.

Upon reaching the head of the comb, we find ourselves in a small valley, the sides of which indicate the limits of the lower limestone shale, which is exposed in one or two quarries along its extent, and is seen to be highly inclined, and in some places much contorted. The crest of Portishead Down is formed by the intermediate beds between the shale and old red; and the elevated ridge on the south-east is composed of carboniferous limestone, overlying the shale, and dipping at angles of from 70° to 80°, towards the south-east.

All these points are remarkably well seen in a valley at the south-western extremity of the ridge, down which a road winds; and if, after having passed the most picturesque part of the ravine, we turn off along a foot-path to the left, we shall see in several places, along the skirts of the wood, the carboniferous limestone appearing on our left, and covered up by the dolomitic conglomerate on our right, towards the marsh; and if we follow this footpath into the Weston in Gordano road, we may continue upon the dolomite, as far as the mill from whence we set out.

Having thus completed the geological details of this district, which, though somewhat irksome to the general reader, will, we hope, prove useful to those who may feel disposed to go over the ground for themselves, we shall shortly enumerate the general geological features of the district under consideration.

I. And first, of the old red sandstone.

1. We have here three distinct and isolated appearances of the old red; of these, the principal includes Portishead Down, and the ground between it and the sea. On the north it is partially covered up by the dolomite; on the north-east it terminates abruptly in a bed of shingle, a patch of alluvial soil, and the dolomite; and on the whole of its south-eastern frontier its termination is gradual, and it sinks under the carboniferous limestone and limestone shale.

2. The second patch is of a narrow horse-shoe figure, and forms the gorge and flanks of a hill between Capenor and the church. Towards the north-west its convex border terminates very abruptly against the dolomite; but in an opposite direction it is gradually covered up by the conformable strata of the carboniferous limestone.

3. The third patch forms the summit of the hill behind the point; it is covered up by the horizontal strata upon three of its sides, but on the fourth, towards the north, it terminates regularly in the lower carboniferous limestone shale.

II. The rock next in superposition is the carboniferous limestone, which also appears in three detached portions.

1. Of these, the first commences in a narrow zone on the top of the hill west of the mill, and, gradually increasing in width, extends in a south-westerly direction, reposing every where conformably upon the old red of Portishead Down, and covered up along its whole south-eastern frontier by the dolomitic rocks.

2. The second portion of carboniferous limestone forms the hill between Capenor and the church, reposing towards the north-west conformably upon the horse-shoe of old red, and covered up in an opposite direction by the dolomite. The external character of this portion is very different from that of the last, and closely resembles the beds under the battery.

3. The third patch forms the ridge of Portishead Point, the basis of the battery, and the shale valley to the south of it. On the south it reposes on the old red, its shale beds being covered up by the dolomite, which nearly encircles it, covering it up towards the sea, and separating the beds of the battery from the rest. These beds are clearly a part of this last ridge, from the rock of which, however, they differ considerably in external character; they terminate abruptly towards the west, against a bank of old red shingle. It should be added, that under the dolomite, towards the sea, the pennant reposes conformably upon the limestone, until, on the dis-

appearance of the latter at the landing place, the pennant dips in an opposite direction.

It is stated, that at low water the carboniferous limestone re-appears below the landing place; but owing to the mud with which the rocks are covered up, this fact, though extremely probable, has not been satisfactorily ascertained.

III. Unless the bed of quartz conglomerate, before described as overlying certain calcareous strata near Down Gate Farm, be considered as the representative of the millstone grit, nothing analogous to that rock has been observed in the district.

IV. The pennant sandstone clusters about the point, but is not elsewhere exposed. It reposes conformably on the northern face of the limestone of the point, is prolonged to the east of it to form an anticlinal line, and then dipping in a contrary direction, and more or less covered up, it skirts the northern bank of the pill, and, with an included seam of coal, crops out through a thin mantle of dolomite, a little to the north of the mill.

V. The horizontal rocks pass so subtlely into each other, that it will be most convenient to consider them all under the common appellation of dolomite.

The rocks above enumerated may be divided under two distinctions, derived from their locality. The first are strictly in situ, having apparently never been disturbed since the period of their deposition. The second set are slightly inclined, and seem to have been subjected to a greater or less change of elevation.

1. The first series extend from the eastern extreme of the point, along its northern face, encircling its western end, capping the carboniferous limestone of the battery, and covering up the depression between the ridge and the old red hill, round which they pass, and skirt the left bank of the pill, as far up as the mill. At the mill itself, the beds are not very distinctly seen; but they become more apparent as they pass to the south-west, in which direction they form a zone of irregular width, covering up the skirts of the hills on the one side, and dying into the marsh on the other.

2. The distinction between the undisturbed and the disturbed beds, is only apparent at certain points. Of these, the principal is above the fork of the roads, between the Down Gate Farm and the church, where for some distance the former are observed, reposing on the west upon the carboniferous limestone, with a slightly conformable dip, and towards the east abutting against the abrupt edge of the old red, by which their edges appear to have been upheaved.

Let us next consider the dislocations to which this district has apparently been exposed.

It has been observed that the rocks of the point, and of the hill behind the point, have a general dip, in a northern or north-easterly direction, while the rocks on the east side of the point along the banks of the pill, and all those lying to the south of a line drawn from the battery to the mill,

have, with one exception not to the purpose, more or less of a southerly dip.

Since, then, the rocks on different sides of the district dip in very different and nearly opposite directions, it is evident that they must be separated by an anticlinal line. One part of this line is visible at the landing place; it must next be carried along somewhere between the old red hill of the point and the coal seam by the mill, and it must emerge on the other side of the peninsula, between the carboniferous limestone of the battery and beach adjacent, and the appearance, at a short distance, of the old red of Woodhill Bay. So that so much of the course of this anticlinal, which arises from and passes into the sea, may be considered as satisfactorily determined.

But there are indications of a second convulsion in this district. It has been observed, that the carboniferous limestone of the battery, after having been much contorted, and laid for some yards in a nearly horizontal position, ceases abruptly, and abuts against a bank of old red shingle, and a triangular portion of alluvial marsh.

Beyond the road, considerably to the south of this, are further indications of an irregularity, in the occurrence of the dolomitic conglomerate upon the summit of a somewhat elevated hill. Following up this track, we come upon the point already described, between the Down Gate Farm and the church; here it becomes evident that the whole mass of Portishead Down and Woodhill Bay has been cast down, that the edges of the dolomitic beds have been turned up during their descent, and that thus the beds of the old red sandstone have been brought once more into view, and a reduplication of the carboniferous series brought about. It would be difficult, without more time and means than we had at our immediate disposal, to estimate with any degree of accuracy the amount of the fall of the downcast portion; but it may be observed, that a bed of quartz conglomerate, occurring in the Woodhill Bay Cliff, may apparently be identified in one occurring at the bottom of the hill, just above the church. The hill lying between Capenor and the church, has apparently been detached by the convulsion, and has undergone a twist round towards the north, so that the bearing of its strata is more nearly coincident with that of those on the northern side of the anticlinal, than with that of the adjacent rocks. The limestone itself, moreover, resembles closely that of the battery, and is very different from the same rock in other places. From the summit of this hill, the line of fault is indicated by the convexity of the zone of old red, and seems to pass down towards the marsh, in the direction of Naish and Charlton Houses, between which its existence has been pointed out by Messrs. Conybeare and Buckland.

It still remains to be accounted for how the dolomitic rocks came to fill up the irregularity caused by the downcast of the old red. At present, the ordinary level of these horizontal rocks does not extend to so great a

height; are we to suppose, which seems the most probable hypothesis, that at one time the horizontal formations extended to a higher level than they do at present, and that the forces by which the present inequalities of the surface were modelled, have swept away the more exposed of their upper strata? Under this hypothesis, the period of the dislocation would have been subsequent to the deposition of the horizontal rocks, which, from their upturned edges, seems certainly to have been the case. The period of the convulsion by which the anticlinal line was formed, seems to have occurred between the deposition of the inclined and horizontal rocks, the latter not having been affected by it, and is therefore much older than the fault.*

It seems probable, from the appearances described, that the Point of Portishead divides two coal fields, the one lying towards the north, and covered up by the sea, and the other extending along the south-eastern skirts of the hills, and covered up by the alluvion of the marsh. Unfortunately, we have been unable to obtain a record of the results of the trial made on a former occasion, near the mill; and although it seems highly probable that a trial for coal in any direction along the south-eastern border of the Portishead hills would be successful, it may justly admit of a question as to the probable thickness of the seams, and the practicability of working them profitably at a nearly vertical dip.

The present report differs in some respects with regard to the direction of the fault, anticlinal, &c. from that referred to as published by Messrs. Conybeare and Buckland. These differences may perhaps be accounted for by the enlarged scale of the present map. In alluding to the labours of these gentlemen, it is but due to them to acknowledge the general assistance which they have afforded us, and to bear a willing, though unnecessary, testimony to the general accuracy of their observations.

* Such of our readers as are in any degree conversant with the Geology of the Clapton district, are aware, that the rocks on the north side of the above fault have been brought, by the convulsion that produced the great Clapton fault, from the ridge of Naish House, a distance of two miles; and that the line of fault, extending from near Naish House to Portishead Battery, is in truth the arc through which the ridge of Walton, Weston, and Portishead Downs has been wheeled. For a clear and masterly explication of the phænomena produced by this convulsion, the reader is referred to the paper on the South-Western Coal District of England, drawn up by Messrs. Conybeare and Buckland, and printed in the Geological Transactions for 1824.

SHORT NOTES UPON THE DILUVIAL AND ALLUVIAL DEPOSITS OF THE TAFFE VALLEY.

The river Taffe occupies a long and somewhat confined valley, extending from Merthyr Tydvil on the north, to the ravine of Castel Coch on the south, when it suddenly expands into a comparatively level plain, across which the river winds to the Bristol Channel.

Between Merthyr and Castel Coch several tributary streams, each flowing down its peculiar valley, fall into the Taffe; of these the Cynnon and Rhonddha are the principal on the west, and the Bargawd or river springing out of the Taffe, the only considerable one on the eastern side. The heads of these subordinate valleys incline more or less obliquely towards the north.

The upper twenty miles of country, composing this valley, consist of pennant sandstone and coal measures; above Merthyr, the carboniferous limestone appears at Morlais, and below the ravine the Lower Garth and Castel Coch mountain present a similar band.

The rocks skirting the plain are, for the most part, dolomitic conglomerate, new red sandstone, marl, and lias. The rocks of the carboniferous series dip at an irregular, but for the most part considerable, angle; those of later origin are more generally horizontal.

Such being then the rocks, of which this valley and the skirts of its embouchure are composed, we shall next pass to its contents.

These are of four kinds.

I. The diluvial gravel, occupying the bottom or trough of the principal and some of the subordinate valleys.

II. The debris, by which the sides of the mountains are masked, and the edges of the gravel more or less covered up.

III. The gravel beds now occupying the beds of the existing streams.

IV. The silt and alluvial mud occurring above all these, in various parts of the valley.

I. Of the diluvial gravel.

This gravel varies considerably, both in the thickness and figure of its beds, in the proportion between the sand and pebbles of which it is composed, in the bulk and figure of those pebbles, in their geological character, and in the direction of their dip.

1. The thickness and figure of its beds depend obviously upon the physical features of the basin in which the gravel is deposited; upon points between the confluence of two valleys, as at Quakers' Yard, it forms a tongue extending up the mountain to a considerable height; above sudden contractions, it forms beds of immense thickness, of which that intersected by the road under Craig-yr-alt may be cited as a magnificent example; and where the valley expands, in which case the plain is formed usually of this gravel. Where the sides of the valley are contracted and nearly parallel, and the mountains steep, gravel does appear to have been deposited.

This gravel does not, under ordinary circumstances, ascend very high up the mountains; and where it does, its escarpment is usually steep. In the bottom or at the mouth of a valley it forms a plain, which, though comparatively level, is not to be confounded with the surface of an alluvial soil, seeing that it is often thrown up into tumps of various figures, and not unfrequently, as near Velindre, stands out in a long lunated tongue, with a steep escarpment on the concave side.

These gravel beds seem due to two modifications of the action of running water. First, that by which the gravel was formed and deposited, which evidently left it in knolls, tumps, and tongues, according to the direction of the current; and secondly, that by which the knolls and tongues when deposited were scarped down, or half carried away, and by which the surface of such plains has been wrought into a variety of channels.

It seems probable, from the sinuosities affected by these escarpments and channels, that they were cut by a stream much larger than the now existing one, but left like that to find its own course down the valley and across the plain; and not by the far more powerful action of the currents, by which the gravel was originally deposited.

2. The proportion between the sand and pebbles, of which the gravel beds are composed, is extremely variable; nor would it be easy, without an extensive examination of the phænomena, both of diluvial gravel beds, and those of actually running waters, to determine at all accurately upon what that proposition depends.

In many cases, no doubt, the softness of the rock will account for a disproportionate quantity of sand; but where sand was most abundant, it did not appear that the few scattered pebbles differed materially from those of other localities, nor that there remained any of them in a crushed or semi-pounded state.

In the beds of now existing rivers, the proportion of sand seems to be greatest where the rapidity is least; and indeed in the gravel beds of such rapid streams as the Rhonddha, there appears at first sight to be no sand at all, though on turning up a few stones, a proportion will be discovered interspersed below.

It should be observed that beds of sand and silt sometimes occur interstratified with the diluvial gravel, and that their general direction seems to be parallel to the surface of the gravel on which they repose, as might have been expected. Attention to this circumstance may perhaps point out the distinction between silt of the age of the gravel, and that deposited upon it at a subsequent epoch.

3. The bulk of the pebbles is also extremely variable; and, in order to make any satisfactory observations upon this point, it would be necessary to examine a valley formed by rocks of considerable geological variety; for the size of a pebble must be affected by the nature of its parent rock, as well as by the distance which it had travelled, or the degree of violence to which it had been exposed. The upper pebbles appear on the whole to be the largest, though this is doubtful; they are not usually so round as the smaller ones, though to this there are numerous exceptions.

The figure and shape of a pebble depends upon causes in a great measure similar: schistose and fissile rocks will of course break up, as a general rule, into flat pebbles; the quartz conglomerate of the old red and millstone grit into very round ones. A compact granular rock, such as

limestone, makes round pebbles, and flints or flint fossils make pebbles according to their original form or fracture.

4. The geological character of the pebbles at any given place, will depend primarily upon the rocks through which the river has flowed; and secondarily upon its powers of wear and tear. In the Taffe and its tributary valleys above Castel Coch, the pebbles are all derived from the sandstones of the coal, with an intermixture, not very copious, of quartz conglomerate. They are therefore of all textures and colours; but, with the exception of the conglomerate, all more or less fissile. The Rhonddha runs nearly down a synclinal line; and the coal, the basset edges of which are exposed by its waters, affords a plentiful supply of pebbles; but these do not travel far from their source, for three hundred yards down the stream they become pulverised, and below that distance scarcely one is seen. The quartz conglomerate occurs, both as rounded pebbles and as semi-rounded erratic blocks.

5. All pebbles that are not round, or that are more nearly flat than round, will be found, if deposited by a running stream, to dip up that stream. Thus all the great body of the pebbles in the valley of the Taffe, and those subordinate to it, dip up their respective valleys, including also those pebbles in the existing water courses. Below the ravine, the pebbles in the plain dip in various directions, but for the most part towards the north. Pebbles on the sea beach dip towards the sea. It would be interesting to compare the pebbles of a slow with those of a rapid stream, to ascertain whether there existed any difference in the angle of their dip.

Whenever a vertical, or even a horizontal section is exposed, the general dip of the pebbles can be readily observed; especially when many of them are large and flat.

With respect to the boundary of the diluvial gravel of this district; below the ravine of Castel Coch, it is bounded on the west by the right bank of the Taffe, as low as Llandaff, whence it extends nearly to Canton, and terminates a little below Pwll Coch on the Ely, resting chiefly on rocks of the new red sandstone series. From hence it extends just south of the village of Canton, through Cardiff, towards Roath, being covered up on this boundary by alluvial mud. Its eastern limits have not been so well determined.

II. We now arrive at the second division of our subject; the debris by which the sides of the mountains are covered up.

Along the sides, upon the platforms, and in many cases ascending very nearly to the summits of the sandstone mountains of the Taffe, lies a coating or mask of greater or less thickness, composed of sand, clay, and fragments of rocks, sometimes with their acuter angles broken off, but more commonly as sharp as when broken from their parent rock.

Those who are at all familiar with the connexion between the physical features of a country, and the geological structure of its rocks, are aware

of the softened, smoothed-off outline of the old red sandstone mountains, of their tabular summits, and of the escarpments and terraces occurring down their sides. Similar appearances occur in the sandstones of the coal, only that the escarpments are steeper (usually bestowing upon the mountain the name of Craig; as Craig-yr-alt, Craig-yr-Esk, &c.) and loftier. Appearances in some points similar to these, are observed on the escarpments of the carboniferous limestone, as for instance, opposite to Piercefield on the Wye.

The debris of which we are treating, usually fills up the platforms of the sandstone mountains, lying there pretty thick, and giving nourishment to ferns and timber trees; or it may be, from the copious springs which gush forth from such mountains, forming a swamp or bog. Between this, with the occasional re-appearance of the rock, the rest of the mountain is completely covered up, the thickness of the covering depending upon its structure and steepness. On the upper platforms the debris is not usually so thick as below, where it occasionally equals fifty or sixty feet. This debris is intersected, and its stones washed out by the waters from above, by which large masses are carried down into the main stream below, and such channels are sometimes very deep clefts.

The fragments in this debris are of variable size and quality, but usually they bear a small proportion to the soil in which they lie imbedded: they have no uniform dip, but lie in the greatest disorder.

It is evident that this debris has been derived from the mountain upon the breast of which it lies, both from the similarity of their composition, and from the fact that had it been brought by a current from any distance, the rocks would have been more rounded, and the soil have assumed more of the appearance of sand. It would seem that this debris has been produced by the action of time and weather upon the faces of the mountains, probably at a period when those faces were more abrupt, and therefore more obnoxious to such agents, than they are at present.

The lower part of this debris overlies the diluvial gravel.

Upon the limestone mountains these phænomena are much less strikingly apparent. These mountains are very deficient in water, and rarely give rise to springs; neither are they so readily acted upon by weather. They are neither so fissile, nor so readily pulverised as the sandstone rocks, and consequently the debris, with which they are sometimes scattered, is composed of very small fragments, with little or no intermixture of soil.

There are observed scattered over the platforms of sandstone mountains —such for instance as the table land between Pont-y-prydd and Pen-y-coed,—a number of huge erratic blocks, derived evidently from the summits of the mountain, and lying in all directions and positions upon the soil. Some lie upon its surface, others are half buried, and of others only a small part is seen. These blocks are rather weather-worn than water-worn; and that they have lain in their present position a long time, is evident,

partly from their grey and weathered aspect, and partly from their decomposed state, the structure of many of them being so loose, that a few rolls would break them up, a state to which they must have been reduced since their arrival in their present place.

The age of these stones, and the very slight quantity of debris (in fact scarcely any at all), which has been formed since by far the greater number of them were placed where they now lie, render it probable that when the mountains had worn down to their present form, they ceased to weather with any thing like the same degree of rapidity, just as any tolerably soft acute hill would speedily become an obtuse one, and then undergo very little further alteration of figure.

III. This brings us to the gravel beds formed by the present rivers. It has been already observed, that the diluvial gravel exhibits marks of a considerable stream, in the form of channels and intersected banks. It is within these larger channels that the present river is found to run, occupying a channel much narrower than the old one, and hollowed out from twenty or twenty-five feet deep in its bed. Besides this, but still within the great channel, are occasionally the marks of old channels formed by the present river, but which it has now deserted.

The banks of the present river are, of course, in all such cases, sections of gravel beds (except in some few instances where the river approaches very near the base of a mountain, and makes a section of the debris), and the pebbles of the bed of the river are for the most part derived from these banks, and are therefore ready rolled.

These modern gravel beds form knolls and tongues, and present, though on a much smaller scale, all the phænomena of the larger beds. The observations made above, with respect to the diluvial gravel beds, are applicable also to these.

IV. The alluvial deposits found in and below the Taffe valley are of two kinds; one, deposited by the Taffe itself, or some of its tributaries; and the other due exclusively to the waters of that arm of the sea into which they fall.

1. The gravel beds and debris of the old or larger channel, which is in some parts, as below Newbridge, of very great breadth, are in many places completely covered up by a stratum of sand or silt, of from one to four feet thick, upon which the present vegetation grows, and which has not therefore for a very long period been much, if at all, added to. This deposition appears due to the overflowings of the present river; not indeed that its waters ever flow within several feet of that level, at present, even in the highest flood; but it is presumed that before the country was inhabited, the fall of trees and brushwood, and the want of proper attention to the state of the banks and drainage of the soil, must have rendered very high floods a much more common occurrence than they now are.

2. The deposition at the embouchure of the Taffe is mud, and not

sand, and is due entirely to the Severn sea. This deposition extends for some distance up the Ely river, forms Leckwith moor, skirts along Canton, the houses of which are on gravel, and passing through Cardiff, extends beyond the Rhymmy. Its thickness it is not easy to estimate, the water upon it is slightly brackish, and it seems on the whole to be slowly increasing towards the Severn. It contains no pebbles whatever.

Without asserting any thing with respect to the manner in which any of the above appearances were caused, but simply by way of illustrating our description, we may perhaps be permitted to state in what manner they *appear* to have been formed.

Let us suppose the mountains to have existed with nearly their present form, but under water, and exposed to a current flowing permanently from the north. This would form a number of pebbles, some of which would remain upon the tops and concavities of the mountains, as they are found round Eglwysilan church, a very few would occupy the sides, and the vast bulk would be rolled along the bottom of the valley, and with more or less sand, according to circumstances, be ejected upon the plain of the embouchure, where they would be subjected either to the waves of the primæval ocean, or to the action of other inland currents: this would fully account for all the appearances observed in the diluvial gravel.

Next we must suppose a period at which the mountains had become elevated above the surface of the water, perhaps to their present altitude, while the damp and newly-raised earth was drained by a copious river, whose waters would flow with considerable rapidity, and occupying a large portion of the bottom of the valley, would intersect the gravel beds in the manner in which we now see them to be intersected.

After another period we must suppose the land to be drained of its greatly superabundant moisture, and to be dependent for its supply only upon the sources by which lands are now ordinarily moistened. Under these circumstances, the river would shrink to its present dimensions, and in the lapse of many centuries, cut for itself its present bed.

Under this hypothesis, the enormous accumulation of debris will readily be accounted for, as the rocks recently elevated from the sea, and surcharged with water, would of course undergo considerable and rapid degradation.

The valley of the Taffe also presents some appearances worth notice, as illustrating the action of water upon rocks.

There are, in various places, both upon the Taffe and Rhonddha, instances in which the river flows over the rock in situ, generally forming a fall, or at least a rapid. About such falls are a number of irregular holes and sinuosities in the rock, formed partly by the water, and partly by pebbles upon which it acts, which may be seen whirling round and round in the holes which they thus both deepen and widen.

Fragments of rock, similarly worn, may be observed on the summits of

the hills bounding the valley, and in situations quite beyond the reach of any existing water course; and in such positions the rock itself in situ is often found to be similarly worn.

Fragments nearly resembling these lie scattered over the carboniferous limestone and oolitic downs of Bristol and Bath, are familiar to every one under the name of rockwork, and are in great request among ornamental gardeners. These differ slightly in figure from the sandstone rockwork, because limestone being neither so hard nor so brittle as sandstone, admits more readily of being pierced through and through in various directions, and of being worn into a number of acute and grotesque points and figures of which the friability of the sandstone renders it incapable.

These holes should not be confounded with those smaller ones in flints, produced generally by the washing out of some fossil of softer material than its matrix.

ON THE STRUCTURE AND FUNCTIONS OF THE ORGANS OF RESPIRATION,

IN THE ANIMAL AND VEGETABLE KINGDOMS.

(Concluded from p. 228.)

Having now glanced at the means by which the function of respiration is accomplished, and witnessed their great uniformity, as well as their universal diffusion, we may pass on to the inquiry as to the precise changes effected by this process, on the animal and vegetable œconomy. There is now good reason to believe, that the analogy which we have seen to exist between the forms of the respiratory apparatus in these two great classes, holds good with regard to their function also. We well know that if an *animal* be placed in a limited quantity of air, so much carbonic acid will be produced, that life can no longer be supported; and that if, on the contrary, we expose a *plant* to the sun, in an atmosphere charged with carbonic acid by combustion or the respiration of animals, the carbon will be absorbed, and oxygen only will remain. At first sight, therefore, the effects produced by respiration in the two kingdoms, appear quite contrary; and it has often been cited as a very beautiful provision of nature, that the air vitiated by the respiration of one class of beings, should be renovated by that of the other. The effect cannot be denied; but another explanation may be given as to its cause.

The experiment just alluded to, which was first performed by Priestley, does not give a fair estimate of the effects produced on the air by vegetables; for it was soon afterwards proved by Mr. Ellis, that plants, not exposed to light, absorb oxygen and give off carbonic acid; and a considerable doubt for some time existed, whether the quantity of carbonic acid given off during the night and in shade, does not equal or even surpass that which is absorbed in open day-light. The recent experiments of Dr.

Daubeny, however, which were performed with the greatest care, show that in fine weather, a plant consisting chiefly of leaves and stems, if confined in the same portion of air, day and night, and duly supplied with carbonic acid gas during sunshine, will go on adding to the proportion of oxygen present as long as it continues healthy; the slight diminution of oxygen and increase of carbonic acid, which take place during the night, bearing no considerable ratio to the degree in which the opposite effect occurs by day.

Professor Burnett has ascertained, by an extensive series of experiments, that the production of carbonic acid is constant during the life of a plant; that it takes place both by day and night, in sunshine and in shade; and that this process is essential to its life; for if deprived of oxygen, and confined in carbonic acid gas, plants quickly die; at least, in ordinary circumstances. This process, which he considers as strictly analogous to the respiration of animals, is performed by the leaves and petals; and in a less degree, by the stems and roots. On the other hand, the green parts of vegetables, at certain times, and under certain circumstances, decompose carbonic acid, and renovate the air by the restoration of its oxygen; but this occasional renovation may be referred, not to the respiratory, but to the digestive system; and so completely is the process dependent upon the stimulus of sun-light, that plants made to grow in the dark, although they increase in size, do not augment the absolute volume or weight of their solid contents, and even lose some of their carbon by respiration. Here again, the analogy holds good between the functions of respiration and digestion, in animals and plants; for to both is carbonic acid deleterious when breathed; and in both is it invigorating to the digestive system when absorbed as food. Plants, when exposed to strong sun-light, will thrive in an atmosphere containing seven or eight per cent. of carbonic acid; but when placed in the shade, they quickly die.

This fact has an interesting connection with the luxuriance of the fossil flora of the coal formations, which abounds in gigantic ferns, lycopodiaceæ, equiseta, &c.;—plants whose development is now much inferior, even in tropical climates. It is the opinion of Adolphe Brongniart, that the atmosphere of that epoch was highly charged with carbonic acid, as well as with humidity; and that these vegetables, by the assistance of powerful sunlight, drew from it that nutriment which there was not sufficient soil to afford them. He considers that by thus purifying the atmosphere, they prepared the earth for the residence of the higher classes of animals.

There are two periods in the life of plants, in which the function of respiration appears to go on with remarkable activity. The first of these is germination, or the process by which a new plant originates from seed; and during its continuance, a large quantity of the surrounding oxygen is converted into carbonic acid, by the liberation of carbon from the seed; and at the same time, a considerable degree of heat is generated. This

liberation of carbon appears to be the effect of the conversion of the original proximate principles of the seed, into those more fitted for the support of the young plant; as, for instance, that of starch or hordeine into sugar.

The changes which take place during flowering, are very similar to those produced by germination. A large quantity of oxygen is converted into carbonic acid by the action of the flower; a considerable quantity of heat is developed; and it is believed that the fecula previously contained in the disk, is changed by this process into saccharine matter, adapted for the nutrition of the pollen and young ovula; the superfluous portion flowing off in the form of honey. It is remarkable that this analogy between germination and flowering holds good, not only in their products, but in the conditions requisite for their development. Neither will commence, except in a moderately warm temperature; both require moisture, for flowers will not open, unless well supplied with ascending sap; and the presence of oxygen is in each case necessary. It is an interesting fact, that, after many trials, it has been found that germination takes place most readily in an atmosphere, consisting of one part oxygen, and three parts nitrogen, which is nearly the proportion of the air we breathe. If the quantity of oxygen is increased, the carbon of the ovule is abstracted too rapidly, and the young plant is feeble; if the proportion is smaller, carbon is not lost in sufficient quantity, and the young plant is scarcely capable of being roused into life.

In studying the changes produced during the flowering of plants, we find a direct relation between the carbonisation of the air and disengagement of caloric, and the development of the glandular disk. This is especially remarkable in the Arum, where a thermometer, placed in the midst of a mass of inflorescence, has been seen to rise to 121°; while the temperature of the external air was only 66°. From the experiments of Saussure, it appears that the disengagement of heat, and the disappearance of oxygen, are principally caused by the action of the organs of fecundation. The Arum Italicum, whilst in bud, consumed in twenty-four hours, five or six times its volume of oxygen; during the expansion of the flower, the spadix being hot, thirty times; and when the flower was withering, five times. When the floral envelopes were removed, the quantity of oxygen consumed by the remaining parts, in proportion to their volume, was much greater. In one instance, the sexual apparatus of the Arum Italicum consumed in twenty-four hours, one hundred and thirty-two times its bulk of oxygen. Saussure also observed that double flowers, in which petals replace sexual organs, vitiate the air much less than single flowers, in which the sexual organs are perfect.

The truth of these statements, which have been questioned by many eminent observers, has recently been placed beyond all doubt, by the experiments of Adolphe Brongniart upon *Colocasia odora*. (Nouv. Ann. du Muséum, vol. iii.) He ascertained that during the emission of the pollen,

the temperature of the spadix rose as much as fifty-two degrees above that of the surrounding atmosphere.

From the absence of a nervous system in vegetables, it would appear that the development of heat during germination and flowering, is to be considered as a strictly chemical effect, arising from the combination of carbon and oxygen; and if so, we ought to find signs of disengagement of caloric by all flowers. It is, however, to be remembered, that in by far the greater number, the heat is carried off by the atmosphere, the instant that it is developed; and that it is only where flowers are collected in great numbers within cases, which act as non-conductors, and confine the heat, as happens in Arums, that the elevation of temperature becomes appreciable.

Some curious observations have been made on the chemical actions of fruit, which tend to confirm the views just stated. During the formation and ripening of fruit, it sustains a considerable loss of carbon, which combines with the oxygen of the air; and when placed in an atmosphere deprived of oxygen, this function is suspended; and, if the fruit remains attached to the tree, it dries up and dies. When fruits, separated from the tree, but capable of completing their own ripening, are placed in media free from oxygen, they do not ripen; but the power is only suspended, and may be re-established, by placing the fruit in an atmosphere capable of taking carbon from it. It appears also that the presence of oxygen is essential to the rotting or decay of fruits. The extrication of carbon appears due, as in germination and flowering, to the conversion of gum, and other proximate principles, into sugar.

Some interesting experiments have recently been made by Marcet, on the effects of plants not coloured green upon the atmosphere. He found that growing mushrooms absorb from the air a large quantity of oxygen, a portion of which appears to combine with the carbon of the plant, and is given off in the form of carbonic acid; whilst the rest seems to be fixed in the vegetable, and to be re-placed, at least in part, by nitrogen disengaged from the mushroom. Here then we have an example of the influence of respiration, unaccompanied by digestion; for it appears that the large quantity of carbonic acid disengaged from the soil in which these vegetables thrive, renders it necessary that the superabundant carbon of the plant should be constantly removed by the atmosphere, instead of any addition being received through that medium.

The changes which are effected in the leaves of plants, upon the sap brought into them by the upper stratum of veins, seem to consist chiefly in the elaboration of the *proper juice,* which flows back along the lower stratum, and descends towards the roots, through the bark, in which various secretions are deposited; part, however, being carried inwards by the medullary rays to the duramen, or heartwood.

We have seen that the organs of respiration in animals are formed on

two principal types, according as the process is carried on in air or water; but the changes effected by them are essentially the same in all. Animals whose respiration is aquatic do not decompose the water which they breathe, but the air contained in it; for if one of this class be placed in a limited quantity of water, from which it soon exhausts the air, or in water from which the air has been expelled by boiling, it dies almost as soon as an animal whose respiration is atmospheric, when placed in a vacuum. If, however, the surface of the water be in contact with the atmosphere, it will absorb air from it; and the life of the animal will be longer, the more fully the quantity thus obtained compensates for that which is consumed. When a fish, in a limited quantity of aerated water, has reduced the proportion of air until its respiration has become difficult, it rises to the surface and takes in air from the atmosphere: but if prevented from doing so, it will die much sooner; a fact which proves that animals whose respiration is aquatic can breathe air, and that this mode of respiration tends to prolong their life in water. What then, it will be asked, is the reason of the death of aquatic animals, when entirely exposed to the atmosphere? Dr. Edwards has shown, by a series of masterly experiments, that it is partly due to the very rapid evaporation which takes place from the surface of the body, and especially from the gills, (about $\frac{1}{14}$ of the whole weight of a fish being lost previously to its death,) and partly to the collapse of the branchial apparatus, which prevents the air from having access to the surface of the filaments. Many fishes are provided with a special apparatus, for keeping the gills moist and free when exposed to the air, and such are able to live a considerable time out of water; and if we raise the gills of other fishes, in which this power does not exist, we may protract life nearly as long as in those cases, where the respiratory movement is continued spontaneously.

It has been mentioned that the external surface of the batrachian reptiles plays a very important part in the aeration of the blood; and Dr. Edwards has shown that cutaneous respiration is sufficient to maintain the life of a frog, for a certain time, without the action of the lungs, not only in the air, but even in water, provided the temperature be low. The air in the latter case must have a very feeble vivifying effect, on account of the very small proportion of it contained in the water; but it suffices to maintain the life of the animal, as long as the temperature is between 32° and 50°. If, however, a slight increase of heat take place, pulmonary respiration is necessary, and the animal takes in air at the surface of the water. During the heat of summer, pulmonary respiration, aided by cutaneous respiration in water, is unable to counteract the effect of the high temperature, and cutaneous respiration in air becomes necessary; and we find that frogs confined to the water at this time almost certainly die. The same influence of temperature is seen on the existence of fishes in limited quantities of water; and the degree of heat which causes frogs to increase their respi-

ration by quitting the water entirely, causes fishes to take in air from the surface—a fact which may be readily observed during the summer.

It is by no means an easy matter to arrive at the precise truth, in experimenting on the chemical changes produced by the respiration of animals; for the function must, in all cases, be more or less disturbed, and the results will be doubtful in the same proportion. We have not yet sufficient evidence to enable us to assert that all animals produce similar alterations in the air; but the numerous experiments made on vertebrated animals, and on some of the invertebrated classes, leave us little reason to doubt the fact.

The principal changes, which we recognise in air which has been respired, are: 1. The disappearance of oxygen which is absorbed; 2. The presence of carbonic acid which has been exhaled; 3. The absorption of nitrogen; and 4. The exhalation of nitrogen.

The oxygen which disappears is usually more than is contained in the carbonic acid produced, so that it must be actually absorbed into the system; and this we find especially the case in the lower classes of vertebrata, and in all young animals. The quantity varies in such proportion, that it sometimes exceeds the third part of the carbonic acid formed, and is sometimes so small that it may be disregarded; the difference depending not only on the constitution of the species, but on the comparative degree of development, and on individual differences among adults. This fact, which was first ascertained by Dr. Edwards, explains the results obtained by Messrs. Allen and Pepys, who found the quantity of oxygen lost, and carbonic acid produced, to be the same: they took the greatest care to obtain accurate results; but their experiments were made with few individuals, and only with two species, man and the guinea pig.

With regard to the production of carbonic acid, there is now sufficient evidence to show that it is not generated by the contact of oxygen and carbon in the lungs, as was formerly supposed; but that it is formed in the course of the circulation, and exists in venous blood when it arrives at the lungs. Dr. Edwards has performed some striking experiments in support of this view. He has shown that some animals may be made to breathe *hydrogen* for a considerable time; and that the production of carbonic acid goes on even more rapidly, up to a certain point, than in atmospheric air. From many recent experiments on venous blood, the fact of its containing free carbonic acid has been put beyond a doubt: and it is a curious effect of the power of mutual diffusion which has been already explained, that venous blood will give off carbonic acid when exposed to an atmosphere of hydrogen, even after it has been submitted to the exhausting power of a vacuum. A slight degree of absorption of oxygen and exhalation of carbon takes place by the skin of most of the mammalia, but to a much less extent than in amphibia.

The question now arises, as to the source of the carbonic acid in venous

blood. It would appear that the oxygen absorbed in the lungs, enters into some feeble combination with arterial blood, and is carried in it to the capillary vessels, where part of it is converted into carbonic acid, by taking up carbon. Dr. Prout has framed an ingenious hypothesis, to account for the disengagement of carbon in this situation. He says that "gelatine, which contains three or four per cent. less of carbon than albumen contains, enters into the structure of every part of the animal frame, and especially of the skin;" and as albumen exists largely in the blood, without any gelatine, he considers that "the conversion of albuminous matter into gelatine, is one great source of the carbonic acid of venous blood." If this be the case, there is another beautiful analogy between the effects of animal and vegetable respiration; the conversion of albumen into gelatine, by the liberation of carbon, being very similar to that of fecula, and other proximate principles, into sugar. Besides this source, however, it is certain that a large quantity of carbonic acid is disengaged in the alimentary canal, during the process of digestion; and it is more than probable, that part of it is absorbed by the mucous membrane with which it is in contact. The quantity of carbon exhaled from the lungs is very considerable; it has been usually estimated in man, at from six to eleven ounces per day; but as the least of these quantities is more than is contained in three pounds of beef, it is probable that both statements must be much beyond the truth.

With regard to the absorption and exhalation of nitrogen, Dr. Edwards has shown that both the processes are constantly going on, but that their relative activity varies in different species, and at different parts of the year. It appeared that an increase in the volume of nitrogen in the respired air took place in most young animals, and during the summer months; but that in the autumn and winter, there is a considerable absorption when adult animals are employed. It is a curious question, which is yet undetermined, whether herbivorous animals absorb more nitrogen from the atmosphere, than those of the carnivorous orders; for as nitrogen scarcely exists in vegetables, but enters largely into the constitution of all animal bodies, it does not seem unlikely that this is the source from which it is derived, when not contained in the food. It is probable that no animal can exist long, if fed exclusively on unazotized principles.

The changes produced by respiration on the animal œconomy are very great: the most obvious are the conversion of venous into arterial blood, and the maintenance of animal heat. The blood which has been charged with carbonic acid, by circulating through the system, is thereby rendered unfit for the support of life; and it is absolutely necessary that this substance should be got rid of, and replaced by oxygen, before the blood is again fit for its varied purposes. This object is effected, as we have already seen, by its exposure to atmospheric air, through the medium of the respiratory surface; and the changes which then take place, are strictly

referable to the principles of the mutual diffusion of gases, which have been already noticed.*

The maintenance of animal heat is a very important function, especially in warm-blooded animals; and we find the temperature of the body very much dependent upon the activity of the respiratory power. Thus in the mammalia, it is usually from 96° to 101°, and in birds from 107° to 111°; whilst in reptiles and fishes, the heat of the body is but a few degrees higher than that of the surrounding medium. John Hunter observed that snails and earth-worms maintained their temperature a little above that of the air; whilst a thermometer introduced into a hive of bees stood at 82°, when the air was at 40°. Part of the latter effect was, however, evidently due to the number collected together. If we extend our observations to hybernating animals, we shall find that their consumption of air lessens as their temperature falls, and as the state of torpidity comes on; and that if, whilst in this state, they are mechanically stimulated to breathe, their temperature rises in proportion to the rapidity of the respiration. It may be observed as a general law, that the temperature of the various classes of animals, and their vitiation of the air are always proportional; and inversely to the length of time that they can live without oxygen. We find also that in animals suddenly killed, the cooling of the body is much retarded, if artificial respiration be carefully maintained. On the whole, therefore, it may be concluded that the combination of the oxygen contained in arterial blood, with the carbon which it meets with in the course of the circulation, is the principal source of the heat developed in the body; and it is probable that the influence of the nervous power in promoting or retarding this combination, will be sufficient to explain those phænomena, which have caused some physiologists to consider the maintenance of animal heat as entirely a vital function. It is remarkable that carbon, which is thus constantly being exhaled from the body during life, should be the substance which, in the spontaneous decomposition of the body after death, is first rejected, uniting with the oxygen of the atmosphere; and Spallanzani found that this process went on to a considerable extent before decomposition was perceptible. He says moreover, that torpid animals, whose respiration had entirely ceased, also carbonated the air, probably through the medium of the skin.

In our examination of this important function, we cannot but be struck with the simplicity and uniformity of the processes into which its apparently complicated phænomena may be resolved, and with the similarity of the means by which they are carried into effect; and the truth of the general conclusion, that "unity of design and identity of operation pervade the whole of nature," is thus forcibly impressed upon us; a conclusion that clearly "points to one great and only cause of all things, arrayed in the

* See page 219.

attributes of infinite power, wisdom, and benevolence, whose mighty works extend throughout the boundless regions of space, and whose comprehensive plans embrace eternity." W. B. Carpenter.

[The author of the foregoing essay (which has little pretension to originality), wishes to acknowledge his obligations to the following works, from which his materials have been chiefly derived, and in which those who wish to pursue the subject will find much additional information. Dr. Grant's Lectures on Comparative Anatomy, published in the Lancet. Traitè Elémentaire d'Anatomie Comparée, par C. G. Carus. Dr. Roget's Animal and Vegetable Physiology. Tiedemann's Comparative Physiology. Elliotson's Physiology. Edwards on the Influence of Physical Agents on Life. Stevens on the Blood. Lindley's Elements of Botany. And, an Essay on Vegetable Respiration, by Professor Burnett, in the Journal of the Royal Institution, N. S. vol. I.]

Supplemental Note to Part I.—The following paragraph is copied from the Supplement to Dr. Alison's Physiology, which has just appeared. "The currents visible in the fluids surrounding many aquatic animals, are evidently connected with their respiration; and it is a very curious observation, lately made by Purkinje and Valentine, and confirmed by Dr. Sharpey, (Edin. New Phil. Journal, vol. xix. 1835;) that similar currents may be seen on the mucous membrane of the air passages in animals of all classes, if immersed in water within a short time after death. But as these are seen equally on other mucous membranes, it is probable that their immediate object is the movement and regular renewal of the mucus covering the membrane, rather than of the air passing over it. In this instance, as well as in the case of the lower animals, the absolute dependence of the currents on the movements of the cilia seen to attend them, appears to have been too hastily assumed by several authors. In several instances at least, it seems certain that both the degree and kind of movement, seen in such currents, are inexplicable by the vibrations of any cilia that have been described."

ON THE SENSE OF FEELING.

Feeling is the most important of all the senses, inasmuch as it is the foundation of our knowledge of the material world; and its relative degrees of perfection in different animals, accompany marked differences in their sagacity.

Feeling has been defined as the geometric sense, being that which supplies us with correct ideas concerning the form and figure of bodies. We derive from it also our idea of solidity.

This sense is extended over the whole body, and the sensations arising from it are excited by the immediate contact of the exciting substance. If we apply a foreign body to the breast or shoulder of a man, he will feel it, that is, he will be aware that he is touched; but he will not have any idea of the figure of this body, because it only touched the skin upon a single plane. And so with such other parts of the body, as do not admit of being adjusted to the different surfaces of foreign bodies, nor are able to bend

themselves, so as at once to embrace the whole superficies. It is therefore a mechanical adaptation, and not the addition of a new sense, which enables us to obtain ideas of figure; although indeed such parts, as for instance the hands and feet, are found to possess common sensibility in a very high degree. It is not because there is a greater supply of nerves at the extremities of the fingers, than in any other part of the body, nor because the hand is endued with the *most* delicate sense of touch, since it is surpassed by the lip and other parts, that it is the principal organ of feeling; but simply because from its peculiar mechanism, it is the only organ which can give us correct ideas of figure; and hence the natural distinction between '*tact*,' the mere sensibility, and '*touch*,' its mechanical application to the forms of bodies. *Tact* is a passive,—*touch* an active sense.

But there is another property of matter of which tact is cognisant, that of temperature. The sense of heat and cold is perfectly distinct from that of form and solidity, although exercised by the same organ. This sense, however, is only relative, and depends entirely upon the quantity of caloric gained or lost by us in a given instant, compared with that gained or lost in the instant preceding, without any reference to the absolute temperature of the foreign body. Cæteris paribus, it is indeed true that bodies of a higher temperature than our own feel hot, and of a lower, cold; nevertheless, if after touching a very cold body, we touch one that is less so, we find it warm, although in truth its temperature is below the general temperature of our own frame. It is for this reason that cellars and cathedral churches feel warm in winter, and cold in summer; while, in fact, they only preserve an equable temperature throughout. The relative condition of tact is well illustrated by the old story of the ascending and descending travellers upon the Alps; or, as the experiment may be more conveniently tried at home, with three basins of water.

But although the anatomist cannot distinguish more than one set of nervous filaments on the surface of the body, for these modifications of the general sense, the pathologist, who studies the animal frame under the dissevering effects of disease, can shew that such a distinction exists.

There is a disease, in which the patient is able to grasp and estimate the figure of any body, but is utterly unable to appreciate its temperature. Such persons have been known to grasp a hot poker, or to plunge the hand into boiling water, and after a certain time to withdraw it, perfectly unconscious of pain, but with the member covered with blisters.

Tact, then, places us in immediate communication with the external world, far surpassing, in this respect, the senses of hearing and sight, which require an intermediate substance for their exercise, and are not only very liable to error, but are often corrected by the tact. I heard it, is good evidence; I saw it, is better; but, I felt it, is tolerably conclusive.

But this sense is not absolutely infallible. We are accustomed to refer

particular impressions to particular parts, by habit. I know that if I place a marble between the tip of my fore and middle fingers, it touches the adjacent sides of each; this I have found uniformly to be the case, and the mind has unconsciously treasured it up. If then I cross the fingers, and thus place them upon the marble, there seem to be two marbles present; for I have an impression felt by the sides of each finger, naturally most removed from each other; and I know that under ordinary circumstances this could only have been produced by two marbles. I am therefore deceived, until set right from another source.

Tact is by far the most perfectible of the senses; and when adventitious circumstances have led to its cultivation, has been possessed in a most astonishing degree.

We must not confound the sense of tact, with what Sir C. Bell has called the muscular sense; that which informs us what muscles are in action, or rather, of the general result produced by their action:—That power which keeps a man erect upon his legs, while the best proportioned statue is obliged to be strongly affixed to its pedestal; or which enables him to know at what inclination his body rests against the wind, and gives him aptitude to adjust himself accordingly.

When a man awakes from sleep, he wakes with a perfect consciousness of the position of his limbs: this cannot be from a recollection of the action which placed them there; he must therefore possess a sense which relates to him their present condition.

This, or something very similar to it, was originally broached by a profound, though short-lived, philosopher, the late Dr. Wells. "What is there," asks he, "within us, indicative of the true positions of the body? to me it appears evident, that since they are occasioned and preserved by combinations of the actions of various voluntary muscles, some feeling must attend such combination, which suggests, perhaps from experience, the particular position produced by it. But almost every position of the body, and the chief of its muscular efforts, are directed towards sustaining it against the influence of gravity. Each position, therefore, in which this takes place, must be attended with a feeling, which serves to indicate its relation to the horizontal plane of the earth."

All animals are enveloped in a membrane, passing under the general name of integument, and interposed between their external structure, and the medium in which they move; and serving to connect together the different parts of the body, to give shape and comeliness to the whole, and to shield it from external injury. It is in this integument that the nervous filaments terminate, and in which, consequently, sensibility resides.

This covering, known to us familiarly in the human body as the skin, is found to present very different appearances in different animals, or in different parts of the same animal, according to the uses intended by nature for it to subserve, or to which the individual may have itself applied it.

It is in man, that this investing membrance is found to be most highly organised, since, besides its other functions, it is, over his whole body, an organ of tact.

Continental anatomists, at all times remarkable for their bias towards analogical discovery, have been disposed to regard the skin as the parent of all the other organs. For each of these organs they have described it as undergoing appropriate modifications, enabling it to discharge the new duties imposed upon it. With respect to the organ of digestion, as the skin may unquestionably be traced into the intestinal canal, as into the other mucous cavities of the body, this view of the question, which has the sanction of the great anatomist, Bichât, seems reasonable and advantageous.

The integument has been considered under two distinctions; one, as relates to the 'forms of animals,' called therefore '*Morphology*;' another, as the seat of a sense, '*Aisthesology*.' Our business with it is chiefly in the latter capacity, though we shall make passing observations upon it under the former. We shall now commence with the integument in man.

Beneath the proper integument, lies a soft couch of membrane or tissue, upon which it is deposited, and which is called the cellular membrane, being composed of a number of plates of membrane irregularly disposed, and forming a series of cells, which communicate freely with each other.

This membrane, in a greater or less quantity, is the connecting medium between almost all the structures of the body: it supports the integuments, invests the muscles, encompasses the different viscera, dips down to form the sheaths of and separations between the nerves, blood-vessels, and absorbents; and, from its uses and extent, becomes a very important constituent of the animal frame. It is in the cells of this membrane that the fat is deposited, as well as, in a certain class of dropsical diseases, the fluid; and it is this membrane which enhances the danger of many surgical operations, not unfrequently, from the low state of its vitality, falling into mortification. The integument, of which the cellular membrane is only the substratum and bed, has been divided, in consequence of the discoveries of Malpighi, an illustrious anatomist in the nineteenth century, into three principal layers, of which the lowest is called the dermis, the next the reticulated or mucous structure, and the third and most superficial the epidermis. We shall, however, on the present occasion consider the dermis and epidermis only as the principal structures, and describe the mucous structure, not as a distinct layer, but as composed of a series of nerves, ducts, and vessels, altogether subservient to the dermis; and in so doing we follow the method* of M. M. Breschet and Vauzeme, as laid down in a paper of which only a portion has appeared; but which, as far as we can at present judge, has, as a record of elaborate and successful investigation, rarely been equalled, and very seldom indeed surpassed.

* Annales des Sciences Naturelles.

The *dermis, cutis,* or true skin, is a dense, fibrous, vascular membrane, containing and protecting the nerves, sanguinic capillaries, and ducts of the part: it possesses firmness and strength sufficient to defend the body it invests, but is supple enough not to impede its movements. Its thickness is very variable, but it almost always constitutes the greater portion of the whole integument. The functions of the cutis are as important, and their due discharge as nearly affects the well-being of the system, as those of the lungs or intestinal canal.

The upper layers of the dermis are very dense, the lower pass gradually into cellular membrane.

The dermis, when examined after long maceration in water, is found to be composed of a great number of fibres, forming a sort of tissue, of greater or less density according to circumstances; and through the interstices between which, the various ducts and vessels of the part are transmitted, some of which, as the nerves and blood-vessels, ramify to such minuteness, that the smallest prick cannot be received without giving pain and drawing blood. The dermis is the seat of those furrows and wrinkles, the absence of which forms one great feature in infantine beauty, while their presence bestows dignity and a venerable aspect upon sorrow and age.

The thickness of the dermis varies, as we have observed, in different parts of the body, being much thicker on the back than on the breast; an observation applicable to most of the mammalia. Over some parts of the body, as the lips and eyelids, the dermis is transparent.

The dermis is of considerable value in the arts, and we are all of us indebted to its preparations for many of the comforts which we enjoy.

Leather is a compound of gelatine and vegetable matter, made by steeping the dermis of animals in infusions of certain barks. The skins are first steeped in lime water, frequently changed, on account of the minute portion of that earth held by it in solution. By this means the epidermis and hair are removed, and the dermis is ready for the second process. This consists in permitting the skin to become more or less putrid, in order to soften it. If at this stage, instead of being permitted to putrify, it be boiled in water, it forms glue. When the hides intended for leather are sufficiently putrid, they are taken out, and submitted in the tan-pit to the action of an astringent vegetable infusion, the strength of which is gradually augmented, until the skin is brown throughout;—imperfectly tanned leather, shewing always a white streak in its centre. Formerly two years was required, to ensure a due penetration of the astringent principle into a thick hide: now, by a happy application of the air-pump, to exhaust the air from the skins, and then of the hydraulic press, to force the infusion into them, the thickest hides are tanned better than before, and in six weeks or two months only; so that the quality of the leather is improved, and its cost diminished.

Such is the *dermis,* the innermost layer of the integument, and such are

its vital and œconomical uses. We next proceed to some of the subordinate structures which it contains.

The upper surface of the dermis is studded with conical papillæ, arranged in rows. Into these papillæ the terminal branches of the nerves may be traced, and the filaments are found on entering the base of each to assume somewhat of a pulpy structure, of which in fact the whole papilla is formed.

These papillæ are therefore considered to be the actual organs of tact; they vary in bulk, length, and frequency, in various cases, and they derive from the outer layer of the dermis a regular sheath, and are still further protected from any inconvenient pressure, by the horny substance of the epidermis, into which they pass obliquely, as a sword into its scabbard

Deeply lodged in the dermis are a series of small glandular bodies, supplied with blood from the neighbouring vessels, and each giving off a long spiral excretory duct, which, passing through the dermis, between the papillæ, finally opens upon one of the ridges into which the surface of the epidermis is wrought. These glandules secrete the fluid of the perspiration from the blood, and their secretion, after traversing the spiral duct, is eliminated in successive drops, upon the surface. So delicate is this contrivance, that M. M. Breschet and De Vauzeme inform us that a little valvular fold of epidermis may be seen to be elevated, before the appearance of each drop. Such are the *exhalants.*

The *inhalants* or *absorbents* do not consist, like the last, of a single tube, but arise, by a multitude of minute vessels, from the lower layer of the epidermis, upon the surface of which their orifices have not as yet been observed. These ramifications collect together into a common trunk, which, passing through the dermis, is supposed to fall into a vein. How absorption is carried on through the epidermis, or whether there be not certain perforations in that membrane, is not at present known; and the termination of these absorbents in veins is only rendered highly probable from analogy, and from the fact that injections have actually been made to pass through the cutaneous structure, from the latter into the former.

Besides these *exhalants* and *inhalants* is found a third system of vessels, said to be for the purpose of secreting the pigment, or colouring matter of the skin. These arise in bulbs, lying between the papillæ, and connected, like the former, with the blood-vessels beneath. Their excretory ducts are straighter than the others, and terminate on the surface of the dermis : the existence of these rests upon the authority above cited, and is, if correctly stated, a discovery of great importance.

The matter secreted by them is styled the *pigment,* or paint.

The pigment is the colouring matter of the skin, being black in the negro, yellow in the copt, swarthy or copper-coloured in the mulatto, and so on. In the inhabitants of the temperate zones the secretion is colourless, or nearly so.

The cause of the dark tinge has been popularly ascribed to the heat of the sun; if so, a vast number of years must be required to produce the effect, for there is certainly but little analogy between the colour of the negro, and the ordinary tan of an European who has been exposed to the sun. Besides which, such a tan is never communicated to his offspring. Moreover, the blackest skins are not those exactly within the torrid zone, and there are nations near the equator, whose hue is almost as light as our own.

There are certain shades, produced by artificial means, which are not re-absorbed: they seem to occupy the seat of the pigment. Such is the tinge produced by the internal use of nitrate of silver. This tinge never affects a cicatrix, that is, a place where the dermis and epidermis are adherent, and the intermediate structures wanting.

We have enumerated, then, as existing in the substance of the dermis, four sets of structures: 1. The *nervous filaments,* terminating in the papillæ of the dermis, the proper organs of tact. 2. The *exhalant glands,* and their long spiral ducts, pouring out the perspiration in successive drops upon the surface. 3. The *inhalant glands* or *absorbent vessels,* rising by a multiplicity of tendrils just below the actual surface of the body, and uniting to form a larger trunk, probably in its turn also tributary to the neighbouring vein. 4. The *glands* for the *secretion,* and *ducts* for the *deposition,* of the *colouring matter,* or pigment, upon the surface of the dermis.

Besides these, are two other sets of organs which we shall describe presently.

We next arrive at the second and superficial division of the integuments, the epidermis.

The *epidermis,* cuticle, or scarf-skin, as it is indiscriminately called, is a transparent, inorganised pellicle, thrown like a delicate veil over the whole surface of the body, dipping into the various cavities, and shielding them from the rude contact of external impressions. Thus we find it spread over the eye as the conjunctiva, upon the cavities of the nostrils as the pituitary membrane; and shutting out all access to the internal ear, by spreading itself over the membrane of the tympanum. Its office is to protect the acutely sensible papillæ of the cutis from too severe an impression, leaving their sensibility in sufficient perfection to answer the ordinary purposes of life.

Agreeably to this intention, it is found to be thicker in those parts which are most exposed, as the soles of the feet, and palms of the hands: and that this is a prospective provision, is shewn from the thickening being found in the new-born infant; though, at the same time, this defence is often produced to meet an emergency; and it is remarkable that labour and continued pressure, instead of permanently abrading and making the skin tender, cause it to assume a thick and horny structure, effectually preserving

the continuity of the surface, though often proving highly inconvenient to the more tender parts beneath.

The lines and decussations, by which the surface of the cuticle is marked, are singular and deserve notice. Upon the back of the hand they are angular and reticulated, upon the palm and sole parallel and elongated; upon the tips of the fingers they form curves and spirals, and a number of very beautiful convolutions.

The structure and origin of the cuticle have been questions much discussed among anatomists, both of the middle and the present age.

Lewenhoek considered it as composed of fine scales; other observers speak of it as laminated, and describe with fatal accuracy the decreasing vitality of each layer as it approaches the surface. It is, however, now admitted on all hands that neither nerves nor blood vessels have been traced into it; whence it is now generally held to be absolutely inorganic, and to be deposited as a rapidly drying secretion from the vessels of the subjacent dermis.

The epidermis is reproduced very quickly, when by any accident it has peeled off; and that it is secreted by the dermis, may be inferred from the fact, that where that basis has been destroyed, no cuticle is again formed.

The epidermis, though exquisitely thin, is not permeable by other than its own fluids; and when, after death, a portion of it has been removed, the dermis and cellular substance beneath immediately dessicate, becoming stiff and hard, and adherent to the muscle below.

The epidermis is not soluble in water, nor in alcohol, but is readily acted upon by an alkali, as any one may discover, who rubs a piece of pure potassa between his finger and thumb.

We now arrive at the two structures subordinate to the integument,—that for its proper lubrication, and that for the secretion of its hair.

The first, the sebaceous glands, are called, from their obscurity, '*Crypts*,' κρυπτα. The last, the growth of the hair being better understood, are called '*Phanera*,' φανερα.

The crypts are small follicles or glandules, secreting an unctuous fluid, which is poured out upon the surface of the body, defending the frame from the noxious influence of moisture, and causing water to stand upon it in drops, as upon a greased substance.

The last system, that of the 'phanera,' is highly interesting; and, as it is the basis of many other structures besides hair, will deserve particular attention.

Lodged in the cellular membrane, below the dermis, are a number of small, oval, and highly vascular bulbs, connected with the dermis by a single stalk, which perforates both that membrane and the cuticle, and which contains the hair.

Such an organ may be divided into two parts, the living secreting bulb, and the dead inorganic hair.

The bulb of a phanerus is composed externally of a fibrous investing membrane, to which its form is due; and which is perforated below for the passage of the nerve and vessels, and above for the exit of the hair.

Within this membrane is a second, composed of the ramifications of the blood vessels, and therefore highly vascular; and within this is a third membrane, composed of the interwoven filaments of the nerve.

The interior of this bulb is filled by a pulpy cone, secreted by the membranes enveloping it, and receiving a very copious supply of both nerves and blood vessels.

It is from the external surface of this cone, as well as from the internal of the investing membrane, that the matter of the hair is deposited.

The substance of each hair is, therefore, divisible into two parts: an external, thin, hard, and polished, bestowed upon it by the vascular membrane; and an internal, softer, and thicker, which is formed upon the cone which thus becomes the mould of the hair, which is in consequence tubular.

The thickness of hair varies considerably, and the colour enables us to estimate the thickness. A German anatomist, with patience characteristic of his nation, has left calculations on this subject: from these it appears that in a square inch of scalp, there are contained, of black hairs, five hundred and seventy-two; of chesnut, six hundred and eight; and of light coloured, seven hundred and ninety; so that the diameter of a hair is least in light hairs, and these are finer the lighter their shade.

Hair is exceedingly durable, and is occasionally found uninjured in old tombs, when the rest of the body has crumbled into dust.

Appended to the euticle, and falling off with it after death, are the nails; they are thick and hard, but inorganic and laminated, growing rapidly from the root to the extremity, and reproduced about every six months.

Beneath the skin which covers the fingers, and upon the back of the last phalanx, are placed a series of bulbs, in very close apposition, the secretions of which grow up together, and form the nail in man, the hoofs and similar appendages in other animals. The general form of the nail depends upon the surface on which it rests; the nails support the ends of the fingers, resist pressure, and thus subserve the organ of touch.

Having thus anticipated a little our order, to adopt the more complete human integument as a type and standard, we shall drop at once to the bottom of the scale, and trace the gradual development of the sense as we approach the summit; and as this sense resides in the integument, we shall consider the various forms, colours, and modification, of that structure, as the investment of the animal frame, and the passive organ of tact; and next point out those restricted portions of it which are more specially organised, and which, admitting of being placed in contact with more planes than one of a foreign body, constitute the active organ, that of *touch*.

The animals of infusions, upon whose organisation so much light has

been thrown by M. Ehrenberg, seem to possess an integument, and probably enjoy the sense of tact;—sensibility to heat they certainly possess.

The actiniæ and certain zoophytes, as the euryale and family of crinoidea, possess tentacula of considerable length, with which they apprehend their food, and which, if endowed with sensibility, may certainly convey to them very accurate ideas concerning the forms of bodies.

The starfish and sea urchin, radiated echinodermata, possess a very obvious integument; and as in these radiated animals the nervous system begins to be exhibited, we may naturally expect to find the organs depending upon it developed in like proportion.

In the starfish the integument is sometimes soft and smooth, but most usually scabrous and tuberculated; the covering being fibrous, and calcareous granules occupying the interstices of the fibres.

The investing membrane of the echini is thin and almost gelatinous, but in its interstices are deposited the calcareous particles for which these animals are remarkable. The deposition of this calcareous case does not resemble that of a regular shell; the particles would rather seem to be deposited in a chrystalline form, a fact which has been supposed to account for the peculiar arrangement of the chrystals, in such of these cases as are found fossil. The spines of this animal seem intended only for passive defence and locomotion.

In the insects we shall find a prodigious improvement in the organs of the senses.

Insects are encased in a calcareous or horny envelope, presenting by far the most complete form of an external skeleton, and formed, according to Latreille, by the excretion between the cutis and cuticle, upon what has been termed the mucous tissue. It is in this tissue that the brilliant colours of insects reside.

Among insects the sense of tact varies remarkably, according to the condition in which they happen to exist for the time; their external surface, upon which the sense, of course, resides, being subject to great modifications, from the larval state in which it is soft and pulpy, to the perfect sheath of the beetles and other coleoptera, in whom it is hard and horny.

In insects, the organs of touch, of prehension, and of locomotion, are found to be more or less distinct: the latter, though well calculated from their mobility and jointed structure to be applied to the surfaces of bodies, being supposed to be superseded, as organs of touch, by the more delicate palpi placed near the mouth.

It is probable, however, and supposed by most entomologists, that the *antennæ*, or *feelers*, as they have been termed, are also organs of touch to most of the insect tribes: this opinion has arisen from their universality, their flexibility, their incessant motion when the animal walks, and the constant employment of them in examining the surface of bodies presented to it.

When the antennæ are removed, the faculties of the insect seem to be for the time destroyed. It is unable to walk or fly, or if it attempts to do so, is evidently bewildered. In the case of bees and ants, whose habits have been more accurately examined than those of most other insects, the utility of the antennæ is very remarkable, and has given rise to the opinion that they are the organs of more senses than one.

The trunks or probosces of the diptera, flies, etc. and the peculiar structure called the nether lip, were supposed by Cuvier to be organs of touch: but in all such speculations it should be borne in mind, that, although it may be experimentally proved that certain senses are possessed by insects, the exact seat of each of them is by no means so apparent.

Although the vital organs in insects are far less complex than in the mollusca, beneath which they are accordingly placed, yet in the development of the senses, and of what may fairly be called the social faculties, they are unquestionably superior. Who, indeed, unacquainted with his minute anatomy, would suppose the bivalve mollusca, the oyster for example, to be higher in the animal scale than the ant or the bee.

The arachnida or spider tribe have long been famous for the accuracy of their tact, as might indeed, from the length and mobility of their limbs, and from the exquisite delicacy of their cutaneous mantle, have been expected; their sensitive powers approach closely those of the insects, the tribe, above which, they form.

In the molluscous animals it is difficult to separate the regular integument from the subjacent cellular tissue; the different parts of the skin here however begin to be apparent, and the pigment or colouring matter is especially distinguishable. The cryptic apparatus in these animals is well developed, and all must have had occasion to observe the quantity of the mucous secretion, in the traces of the slug or snail. They do not possess hair, nor any thing analogous to it.

In many of the mollusca, as the slug, this integument completes their covering, and such are termed naked; but in others, a calcareous secretion is deposited in the structure of the skin, and forms what is familiarly known to us as the shell.

Although the general flexibility and softness of the surface of the mollusca might seem to indicate a favourable disposition for the apprehension of bodies, the sense of tact does not often appear to be possessed by them in any very high degree, nor do we find any very remarkable apparatus for the exercise of touch.

In many of the acephalous mollusca, besides the digitations of the mantle, are found others assuming somewhat of the appearance of tentacula; and in some of the higher animals these tentacula are more fully developed; they have been supposed to be organs of touch.

The muscular disks occupying the inferior parts of those mollusca, which are hence called gasteropodes, are highly organized and probably

sensitive. The whole lower surface of such animals admits of being minutely injected, exhibiting the increased vascularity which is said to accompany sensation.

The first class of mollusca, the cephalopodes, are in many respects very singular animals. In them is found the first rudiment of an ear, and their tentacula are numerous and flexible. In the cuttle fish, under favourable circumstances, they enclose a circle of twenty or thirty feet diameter, and have been known to close upon and drown native divers, who had descended to obtain the animal as an article of food.

Fishes, to ascend to the vertebrated animals, are by no means remarkable for the delicacy of their tact; for being without extremities, and consequently being incapable of grasping any object save with their mouth, such a sense extended over their body would be useless and perhaps prejudicial to them. Upon the lips and snout, their natural organs of prehension, we do, not unfrequently, find this sense to be bestowed.

The integument of the greater number of fishes is familiar to all under the appellation of *scales;* these being horny, and in some cases calcareous laminæ, overlapping one another, and forming, with the metallic hues of their pigment, a complete and brilliant covering.

Scales are developed upon the surface of the cutis, from which they are not distinctly separable. The manner of their production is obscure, since they have no bulbs like hair or feathers, They are, I believe, at present supposed to be secreted by the vascular membrane; rising in a sort of flattened pouch of that membrane, composed of a series of flattened cones, and shooting out in a radiated direction according to the figure of the individual scales. The scales of the greater number of fishes are arranged in an '*imbricated*' manner, that is to say, like the tiles of a roof, each scale being marked by striæ parallel to its sides, or proceeding in a radiated manner to its plane or indented margin.

In some fishes, as the bichir, etc. the scales are very thick, but only slightly overlapping, although, being strong, serrated, and set very close, they form a very secure covering.

In certain other fishes, as the *eel,* the scales do not overlap at all, but fit neatly together, and are encrusted by a strong epidermis. Analogous in some respects to this is the integument of certain mammalia of the *seal* family, familiar in a dried state to us all. There the cutis is strong and fibrous, and presents a series of rough prominences of greater or less size, in various parts of the body, forming when dry the seal skin of commerce.

In the diodons and tetraodons, this structure is still further developed, forming sharp prickles or spines, manageable by a general muscle connected with their bases.

In the cyclopterus, or lump fish, the scales are conoidal or tubercular, varying in size, and adhering by their base to the integument, but leaving an unprotected vacuity between each.

The scales of fishes are by no means equally arranged over the whole body, sometimes being wanting on the head, and in other cases extending to the tip of the snout. The fins are in this respect also variable.

In fishes, the lateral line of scales presents many singularities, being sometimes worked into grooves, at others rising into a ridge on either side of the tail. The ventral scales are also frequently singular. In the *herring* they are arranged so as to form a sort of external sternum. The reason why fishes, generally speaking, should be clad in scales, seems obvious enough. Being cold-blooded, that is of a temperature varying with that of the medium in which they live, they need not the warmth supplied to land animals by hair, wool, feathers, etc.; while their smooth and polished surface enables them to glide through the water with rapidity, and to pass at full speed, with perfect facility, among rocks and prominences, by which a harder or less polished shield would be broken or torn.

The epidermis, or exterior coating of fishes, is mucous and very slippery. It is of course constantly moist, and it falls off in shreds, at certain seasons of the year.

There are some fishes, as the lampreys, myxine, etc. whose integument is entirely gelatinous, and who have no scales. As a general rule, it has been observed that scales, properly so called, are confined to the higher or osseous fishes; and that osseous plates, or a naked skin, are the portion of the cartilaginous.

Let us now pass to those parts of fishes to which a more plentiful supply of nervous energy is directed, and which, from their mechanism, are capable of becoming organs of touch.

The appendages termed 'barbels,' which surround the mouths of the silures, lates, gades, cyprins, etc. and the filamentous structure observed upon the pectorals of some fishes, together with the radii from the head of others, are all plentifully supplied with nerves; and no doubt by their vibrations give notice to the animal, and enable him in some degree to estimate the body before him.

The barbels, according as they are placed round the mouth, the nostril, or at the angles of the mouth, are termed labial, nasal, oral, etc.

In fishes whose residence is in the sand, these barbels are well developed. In the sturgeon, the supply of nerves to them is particularly copious.

The processes of the zeus ciliaris are employed to grapple and coil round the stems of plants, and are therefore probably organs of touch.

Organs similar to these have been described by M. Jacobson, as existing in the *sharks* and *rays*, and which, though very different in their structure, have been functionally compared with the feline whiskers. These organs, it appears, are situated upon the lateral and inferior parts of the head, and they consist of certain nodular cavities, placed at some distance beneath the skin, enveloped like the bulb of a hair in a fibrous capsule, and containing within a number of nipple-shaped projections, from each of

which a small tube rises, supplied by a powerful nerve, but ceasing at the surface.

Such an organ appears to hold an intermediate place between a '*crypt*' and a '*phanera,*' resembling the latter in its nervous supply and pulp, but analogous to the former in their assemblage together upon certain points in a conglomerate form, as well as in their external orifice.

It has been supposed that these fishes, by such organs as these, exercise the sense of touch with considerable accuracy.

Ascending from the fishes, we arrive at the reptiles, divided into two classes; the naked and the scaly. Of the former, are the batrachians; of the latter, the ophidians or serpents, the saurians, and the chelonians, or tortoises.

The batrachians have neither a distinct epidermis, nor phanera for the production of hair; but the whole integument partakes of the character of a mucous membrane, and is copiously supplied with slime by a well developed system of crypts.

In these animals the cutis is dense and (with one exception) adherent, as in the fishes. They possess a vascular membrane, and the pigment is exceedingly brilliant.

In the frogs proper, the skin, instead of being adherent, is attached only at the extremities of the animal, so that it admits of being readily inflated like a bag. It forms also, in species regularly aquatic, the interdigital expansion called a web foot.

In the proteus, siren, terrestrial and aquatic lizards, animals which have been called pseudo-saurians, the cutis becomes exceedingly gelatinous, and is closely adherent to the subjacent tissue.

The tegumental difference between the ophidians and batrachians, and the two inferior classes of reptiles, the chelonians and the saurians, consists chiefly in the scales or hard coverings with which the latter are invested; in the position of the pigment, which resides most usually upon the surface of the scale itself, instead of upon the subjacent cutis; and in the possession of something like nails.

The scales of reptiles are, however, to be regarded as distinct from those possessed by fishes on the one hand, and by the pangolins and some of the mammalia on the other; their solidity being entirely due to a thickening of the epidermis.

The scales of reptiles have been divided into *epidermoid, dermoid,* and *phaneric.*

Where the scaly portion is circumscribed by lines or spaces, within which the epidermis is less hard and more flexible; and where the scales are flat or nearly flat plates, they are called *epidermoid:* where they rise to a greater elevation above the skin, forming a scaly tubercle, and being more immediately connected with the dermis, they are called *dermoid:* and where they overlap one another in the inbricated manner, becoming

in fact, scales in the usual acceptation of the term, they are called *phaneric:* —a bad term, for they are not secreted by phanera at all. The figure and structure of these scales and plates form, as in the fishes, grounds for zoological distinctions.

At certain periods, scaly reptiles cast their epidermoid covering, not as in man and the mammalia, piece-meal, but at once, so that the animal steps out of his skin, as out of a sheath, leaving a correct mould of himself behind him. So complete is this shifting, that even the outer layer of the cornea has been found with the skin. After this process, the colours of the new skin are, of course, for a time more vivid and brilliant, and this is peculiarly the case with the snake.

Of the scaly reptiles, the serpents possess an integument of considerable strength, not very sensitive. The cutis of many of them, as the Boa, is highly elastic, especially about the neck.

The Lizards are protected by scales, more or less imbricated; and in those in whom the feet are not at all, or but imperfectly, developed, the integument is very dense, and the scales of the dermoid description. The feet of the higher classes of lizards are furnished with nails, and their brilliant colours are said to depend upon the solar rays.

In the Iguanas the integument is thick, especially about the tail. The scales are dermoid, but not imbricated; and their colours often brilliant. They have a strong sharp nail upon each digit, and are said to be the highest animals in whom are found the '*femoral pores.*' These are perforations, determinate in number in each species, one of which passes through each scale, near the inside of the thigh, being the excretory of a small crypt below.

In the Agamas, the skin is thinner; and the great development of the vascular tissue in these animals, and more especially in the cameleons, will explain in some degree the singular property which they possess, of changing their colour.

In the Geckos, the integument is tolerably soft and mucous; they have a nail upon each digit, but upon that corresponding to the thumb, it is so small as frequently to have been overlooked.

In the Crocodiles, the skin is adherent in a very remarkable degree, especially about the cranium, where it seems almost to form parcel of the bone. It is thick and hard upon the back, capable of turning a musket bullet; rather less so upon the belly and flanks; and materially thinner at the flexures of the joints, and upon the interdigital expansions.

The epidermis of the crocodile forms those broad rectangular plates, which cover the lower part of the animal from one extremity to the other, and which, meeting along the back, form a rigid crest.

The nails are small, and do not exist upon the outer digits.

The tortoises and turtles, the highest of the class reptiles, are remarkable for the extreme beauty of their case. In these animals the cutis is

thick, serrated, and resisting. Where it covers the bone, as upon the head, it is thinner, but strongly adherent. In them the vascular network is not strikingly developed, and the pigment is almost fluid.

The shell of these animals must be considered as formed by the cutis; and the thin plates which peel off, and form the tortoise-shell of commerce, as the representative of the epidermis. There have not been discovered any vestiges of a cryptic or phaneric system.

The beautiful forms into which the plates forming the covering of the tortoise family are thrown, are familiar many of them to us all; but they are delineated in a manner which seems to equal nature under her most favourable circumstances, in the magnificent plates of Mr. Thomas Bell.

In the class of reptiles we find upon the whole a very inconsiderable advance in the perfection of the organs of tact and touch, compared with what we shall see in the higher classes. Their organs would seem to be in a sort of transition state, many of them possessing the smooth and flexible integument usually accompanying perfection of tact, while the forms of others are so constructed, as to make the most of such an organ; the two advantages not being, however, combined in any great degree in the same animal.

In the lower and amphibious reptiles, as the frog, &c. the skin we have seen to be delicate and polished, and apparently very fit to exercise the sense of touch. The anterior extremity of their trunk is, however, never elongated into a snout; and although the posterior becomes occasionally a tail, it is commonly stiff and rigid, and useful chiefly as an organ of locomotion, a use to which the extremities seem almost entirely to be applied.

In the Pipa, however, the fringes which skirt the extremity of the digits are, it is probable, organs of touch.

The shape and flexibility of the serpents would render their whole bodies an admirable organ of touch, but that their cutis is thick and scaly, and almost incapable of receiving impressions.

Such of the saurians as want the hind legs, are but little removed from the serpents; and even where the digits exist, and are long and mobile, they are used rather as organs of locomotion.

The cameleons and geckos, possessing thin skins, long digits, and long prehensile tails, are probably superior in respect of this organ to most of their associates. The tail of the cameleon is remarkable for its length, and is one of the points of declination from the lizard to the serpent type.

In the crocodiles and tortoises the sense of tact is probably feeble.

Speaking generally, although in the class reptiles we find an obvious modification of the type, preparing, as it were, for the development of the sense; yet the requisite supply of nerves, and thinness of the cuticle, are deficient.

Leaving the reptiles, we next arrive at the birds; and the principal tegumental difference between the two classes consists in the possession of

plumage by the latter, in the relative thickness of the cutis, in the almost total absence of pigment, in the substitution of a bill for the dental system, and in the prodigious development of the phaneric system by which the feathers are secreted.

The integument of birds is composed of the same parts with that of man. The cutis is usually thin, especially over those parts covered by plumage; on the legs and feet, however, it is very thick. It is also thick in aquatic birds, and those inhabiting cold climates, being moreover replenished by a subcutaneous layer of fat.

The vascular portion is more highly developed than in any other class of animals, the organs which secrete the feathers requiring a copious supply of blood.

The pigment, wanting over the body, appears upon the legs and feet. The nervous layer is not particularly evident.

Where the plumage is thick, the epidermis is scarcely perceptible; but where there are no feathers, as upon the legs and feet, and more especially upon the under surface or soles of the latter, is it well developed. The callosity upon the breast of the ostrich and cassowary, against which those birds rest when sleeping, is epidermoid.

The cryptic system in birds is chiefly developed about the back and neighbourhood of the tail; and its secretion is in many aquatic birds very profuse, and of a rancid odour.

The phaneric system, though modified to secrete feathers, resembles, in its general arrangement, that which has been already described as secreting hair.

Besides the claws with which the feet of birds are provided, a few, as the ostrich, have something analogous to them upon their upper extremity; that bird has two on each wing.

The beaks of birds are occasionally, as in the duck, organs both of taste and touch; but the general sense of tact is not very strikingly exhibited in this class, and their feet, with the exception above mentioned, form almost the sole organ of touch.

If we examine the bird's foot, we shall find the cushion which forms the sole to be perhaps the softest part of the body. This is true even of ostriches and ambulatory birds, and, in a very remarkable degree, of birds of prey.

We have observed, that as we ascended in the scale, the different parts composing the integument became more distinctly visible; and this we shall find to be very obviously the case with the mammalia.

In the mammalia, the dermis, though very variable in thickness, is always more or less moveable on the parts beneath, the subjacent tissue being never, as in the heads of the turtles and legs of the birds, wholly wanting. There are, however, parts at which the integument is more adherent than elsewhere, as along the median line, on the tail, &c.

In the mammalia, generally, the integument is thicker upon the back

and outer sides of the members, the parts most needing its defence. In some animals, however, as the badger, tapir, &c. who throw themselves on their backs at the approach of an enemy, this rule is reversed, and the skin of the abdomen is thicker than that of the back.

In man, an upright animal, there is but little difference, the skin of the back being, however, a little the thickest.

The condition of the integument of the mammalia varies very considerably with the habitudes and locality of the animal.

As a general rule, the integument of the male animal is rougher and thicker than that of the female.

In the mammalia the cellular or subcutaneous tissue is filled commonly with fat, the consistency of which varies with the habits of the animal. In the ruminating animals it is of firm consistence, and is called '*tallow*.' In the pig it is thicker and more homogeneous, and forms '*lard*.' In the cetacea, or whale tribe, where it bears the name of '*blubber*,' it is an exceedingly viscid fluid, and escapes from a cut made through the skin, without the aid of pressure. In these animals it renders the body specifically lighter than the fluid they inhabit; and, by its non-conducting power, preserves these warm-blooded giants of the deep from severe changes of temperature.

There is found in some of the lower classes, in the birds for instance, a structure only fully developed in the mammalia. It is an universal muscle, interposed between the integument and the body, the greater part of which it covers.

It is called the 'panniculus carnosus,' or 'fleshy pannicle,' and enables the animal to corrugate his skin, and set up the hairs that lie over it; and thus to free himself from dirt or insects, without the aid of his extremities, of which only the tail is usually sufficiently flexible for the purpose. A muscle, in its action remotely analogous to this, covers the human scalp, and enables some persons to set their hair on end at pleasure.

Although the skin, usually, is only sufficient to cover the body, it is occasionally formed into pouches or appendages of considerable size. Thus it forms the dewlap of the buffalo and Cape bull, and the marsupial appendage of the opossum and didelphous animals.

With a few exceptions, the skin of the mammalia is covered over with a filamentous structure, or '*pélage*,' a general term, including wool, fur, &c. Hence the mammalia have been called 'pilifers,' and the birds and fishes 'pennifers' and 'squammifers.'

The colour of the pélage is usually some modification of white, black, deep brown, or yellow. These colours are usually more brilliant on the most exposed parts of the body.

The colour is often variable: the young of some animals are marked by spots that disappear in the adult; and in cold climates many animals become white or grey during the winter.

The mammalia generally cast their coat at a certain season of the year, and it is replaced by another. In winter the fur is usually much thicker than during the warmer seasons, and possesses a larger quantity of duvet, or intermediate short silky hair, which is an admirable non-conductor of heat. As a general rule, the animals inhabiting cold climates possess long, silky coats; those in hot climates, short, dry, and harsh ones.

The external coverings of the mammalia are then very various. In the cetacea the integument is polished and slippery, calculated for motion in the water. In the sheep the wool is more or less silky: in the cow and horse the hair is short. The skin of the elephant and rhinoceros is, as their name of pachydermata implies, very thick; that of the hog is very dense, and makes, therefore, excellent saddles. The ornithorhynchus is covered with short fur, the armadillo with bands of mail, the pangolin with scales, the beaver with thick felt, the porcupine with quills, the hedgehog with bristles, the monkey with hair.

Horns are of two kinds, solid and hollow.

Hollow horns are formed around a solid bony axis, a process from the frontal bone, the horn itself being a thin shell, inorganic, and deposited in conical layers. Such horns do not fall off: of this kind are the horns of the ox, antelope, ram, &c.

Solid horns are altogether different. They are formed of an agglutinated mass of hair, the bulbs secreting which lie in juxtaposition below. These horns are fibrous, pyramidal, are connected only with the skin, and are reproduced from below, as they are worn away above. The horn of the rhinoceros is of this nature.

The scales of such of the mammalia as possess them, are formed in a similar manner, the bulbs being placed in a line, or an eccentric ellipse, instead of a circle; as may be well seen in those of the pangolin, or ant-eater.

The antler of the stag is a real bony process, growing not from its base, but from its extremity, covered to a certain stage of its growth with hair, and it is deciduous.

During its growth, the antler is invested by a vascular periosteum, or membrane, by which it is nourished, and into which the vessels pass through the osseous circle at the root.

When an antler is completely formed, which occurs after about three months, the vessels at the root contract and degenerate; and the periosteum, deprived of its nutritive fluid, peels off.

When the animal sheds its antler, the integuments close over the denuded bone, and thus remain until the proper season, when the same circle of changes is recommenced.

Besides the general sense of *tact*, which resides in a greater or less degree over the integument of the mammalia, they are endowed with special organs of *touch*; that is, there are certain parts of their bodies, adapted

mechanically to enable the animal to appreciate the figure and bulk of bodies.

These parts vary in different animals. In the American monkeys the tail is the organ of touch; and the young of the opossum are known to curl their tails round that of their mother, and so to steady themselves upon her back, while she escapes from the enemy. In all these animals the under surface of the tail, and that only, is naturally deficient in hair, and highly sensible; while in the kangaroo, whose tail, though remarkably large, is not prehensile, there is no difference between one part of it and another; and in many other animals, possessing large and magnificent tails, there is no remarkable development of tact.

Bats are remarkable as being able to fly about with perfect facility, either in the dark, or with a very moderate share of light; and it is said, even after their eyes and ears have been destroyed. Some naturalists have claimed for them a sixth sense, and placed it in their wings. That the wings are well supplied with nerves is true, but there is no necessity for supposing a new sense, since, even if they do fly readily in *absolute* darkness, which is doubtful, we might much more easily suppose that a very delicate sense of touch would take cognizance of the returning waves of the atmosphere, just as a blind man becomes aware of the existence of a wall a little before he reaches it.

In those animals in whom the extremities are used only for locomotion, the sense of touch resides elsewhere: in the elephant it is found in the extremity of his long and flexible proboscis; in the horse in his full lips; in the hog in his elongated snout. But of all these, the trunk of the elephant is by far the most complete; and, as an organ of attack and defence, of prehension and of touch, is superior to every other of the mechanical contrivances of nature, excepting only the human hand, with the description of which organ we will conclude.

With the general appearance of the human hand we are all familiar. We know that is placed at the extremity of the fore-arm, that it commences from the wrist, that it is divided into a palm, fingers, and a thumb, that the fingers are articulated to the palm by the joints called the knuckles, and that each of them is divided by two joints into three pieces, but that the thumb possesses only two.

But, duly to appreciate the mechanism of this organ, it is necessary to examine rather more deeply into its substance. We shall commence therefore with its skeleton.

The hand is composed of twenty-seven bones, which are divided into carpus, metacarpus, and phalanges; and it is articulated at the wrist with two others, the radius and ulna.

The carpus consists of eight bones, arranged in two rows. The bony articulations of the wrist joint are carried on between the radius above, and the three upper carpal bones below, the connexion between the ulna

and the carpus being merely ligamentous, and therefore not apparent in the dry skeleton.

The lateral bones of the carpus incline forwards, forming a hollow for the protection of the blood-vessels.

To the three inner bones of the second row of the carpus, and to one side of the fourth, are articulated the metacarpal bones of the four fingers, and opposed to these is the metacarpal bone of the thumb. These metacarpal bones are hollowed towards the palm, and, although united at either end, recede from each other centrally, for the lodgement of muscles. The further ends of these bones form the knuckles; they are round-headed, and fit into corresponding concavities in the bones of the fingers or phalanges.

The first row of the phalanges is common to all the fingers and the thumb; the second is wanting to the thumb; the third again is common to all, forming the tips, and being flattened for the support of the nail.

The bones which we have been describing are held together by a number of fibrous bands, destitute of sensation, save when placed upon the stretch, and called ligaments.

Strips of these ligaments run in all directions from one bone to other, and, by taking off from the jar, materially diminish the bad effects of a fall. The most remarkable of these ligaments is stretched across the arch of the palm, and thus ties down and alters the direction of the tendons, affording also a safeguard to the nerves and vessels beneath.

Each of the very numerous joints, formed by the bones which we have been describing, is enveloped by a shut sac, called a synovial membrane, from the interior of which an oleaginous fluid is secreted, for the lubrication of the joint.

Having fastened our bones together with appropriate ligaments, and supplied the joints with a fluid sufficient to prevent the injurious effects of friction, we next proceed to clothe them with muscles, and, before we do this, it will be proper to consider what motions will be required of them.

The motions of the human hand may be considered as of two kinds, those which it exercises to give effect to the motions of the arm and fore-arm, of which it is the extremity, and those which are more especially confined to itself. The throwing up a cricket ball is an instance of the one, the management of the strings of a violin of the other.

Now, to execute two such different sets of motions, two distinct arrangements of muscles are required. Thus there are a number of muscles, which bend or extend the wrist on the forearm, or which pronate or supinate the hand: almost all of these are placed upon the upper part of the fore-arm, where they form the graceful swell of that part; while their long slender tendons run down to be affixed to the wrist and fingers, where for obvious reasons it is necessary that each part should occupy as little room as possible.

The other set of muscles are smaller, and formed rather for celerity of motion than strength. They lie upon the palm of the hand, between the bones of the fingers and around the thumb, and are the means by which the fingers are enabled to play upon a musical instrument.

There are no less than forty muscles belonging to the hand, of which twenty lie upon the forearm, and act through their tendons, and twenty lie upon the hand itself, and round the joints which they move. The thumb, forefinger, and little finger, possess peculiar muscles of their own.

This muscular system has next to be supplied with blood. This is managed by three arteries, which, coming down the wrist, are distributed upon the palm and fingers; two of them forming very beautiful arches, from the convexity of which the arteries of the fingers are sent off.

The supply of blood to the hand is large, the constant muscular action of the part requiring constant replenishment.

The hand is supplied with nerves from a variety of sources, which it would be tedious here to enumerate; neither need we dwell upon its absorbents.

We have then, to recapitulate, the hand, composed of bones, giving support and a determinate figure to the whole; of ligaments, by which those bones are held together; of muscles, by which they are moved upon each other, and which bestow upon the hard and harsh bones a graceful and flowing outline; of blood-vessels, by which the muscular fabric is kept in constant readiness for action; of nerves, by which the motions of the parts are excited; and of absorbents, by which the whole is prepared for renovation. For all the purposes of active motion, the instrument would seem to be complete; but other offices are to be performed, and therefore other structures are superimposed.

Of these the chief is the integument.

Upon the surface of the muscles, passing between their interstices, filling up all their vacuities, bringing up the whole to a uniform surface, and forming a proper cushion for the skin, is the cellular membrane, and upon this rests the skin itself.

The whole anterior surface of the hand is much more highly organised than the posterior, and there are observable upon it a vast number of those convoluted lines of papillæ, which denote a powerful development of the organ of tact.

The organ which has been described is perhaps the most wonderful in nature. It is remarkable that every other organ, with the exception of that of touch, is found more perfect in brutes than in man. The eye, the ear, the nostril, the tongue, are all inordinately developed in some one or another animal, but the sense of touch, as exhibited in the human hand, is singular and supreme.

Frequently, in considering the moral, and sometimes in contemplating the physical, arrangements of Nature, that is of God, we are apt, in the

presumptuous rashness of ignorance, to imagine "that we could have arranged it better." At the sight of the hand, this idea could not for a moment arise. It seems, at once, impossible to devise an instrument better suited to its multifarious work. The beautiful arrangement of its *bones*, the contrivance exhibited in its well placed *ligaments*, the elegant form of its complex *muscles* and *tendons*, the regular distribution and careful defences of its numerous *nerves*, *blood-vessels*, and *absorbents*, and the *integument* with which the whole is invested, are each of them wonderful, and in perfect harmony with the rest.

Some animals, says the learned Ray, have horns, some have hoofs, some teeth, some talons, some claws, some spurs and beaks; man hath none of all these, but is weak and feeble, and sent unarmed into the world. But a hand, with reason to use it, supplies the place of all these.

It is not, observes Buffon, only because there are a greater number of nervous tufts at the extremity of the fingers, than in any other part of the body; it is not, as is vulgarly pretended, because the hand possesses the most delicate sense, that it is in effect the principal organ of feeling: on the contrary, we can say that there are parts more sensible, and where the sense of feeling is more delicate, as the eyes, the tongue, etc. but it is merely because the hand is divided into many parts, all moveable, all flexible, all acting at one and the same time, and all obedient to the will; it is because it is the only organ which gives us distinct ideas of the forms of bodies.

Animals which have hands appear to be the most acute; apes do things so resembling the mechanical actions of man, that it seems as if they had the same succession of corporeal sensations for the cause of them. Animals which are deprived of this organ cannot have any distinct knowledge of the form of things; as they cannot grasp any object, and as they have not any part divided and flexible enough, to be able to adjust itself upon the superficies of bodies, they certainly have not any precise notion of the form any more than of the size of them.

It is for this reason, that we often see them in suspense, or frightened at the aspect of objects, which they ought to be the best acquainted with, and which are the most familiar to them. The principal organ of their feeling is the muzzle, because this part is divided into two by the mouth, and because the tongue is another part, that serves them at the same time to touch bodies, which we see them turn again and again, before they take them between their teeth.

Perhaps one of the most beautiful tributes to creative skill, as well as one of the most striking instances of rough unhewn reason, is contained in the following passage from Mr. Ellis's Polynesia, as quoted by Mr. Conybeare in his inaugural address.

"On a public occasion, in the island of Raiatea, during the year 1825, a number of the inhabitants were conversing upon the wisdom of God,

which it was observed, though so long unperceived by them, was strikingly exhibited in every object they beheld. In confirmation of this, a venerable and grey-headed man, (whom Mr. Conybeare appropriately terms the Polynesian Paley,) who had formerly been a sorcerer or priest of the evil spirit, stretched forth his *hand*, and, looking at the limbs of his body, said; 'Here the wisdom of God is displayed:—I have *hinges* from my toes to my fingers' ends; this finger has its *hinges*, and bends at my desire; this arm, on its *hinges*, is extended at my will; by means of these *hinges*, my legs bear me where I wish; and my mouth, by its *hinge*, masticates my food. Does not all this display the wisdom of God?'"

A SKETCH OF THE PRESENT STATE OF OUR KNOWLEDGE OF THE LAWS OF CHEMICAL COMBINATION,

WITH SOME OF THEIR MORE IMPORTANT APPLICATIONS.

In watching the progress of those branches of science which are most rapidly advancing at the present time, we may generally observe that whilst apparently becoming more complicated and difficult of attainment through the rapid accumulation of individual facts, they are really increasing in simplicity, owing to the discovery of general laws, which are based upon some of these facts, and lead to the knowledge of many others. "Every new discovery in science," says Sir J. Herschell, (Discourse on the Study of Natural Philosophy, p. 358) "brings into view whole classes of facts which would never otherwise have fallen under notice at all, and establishes relations which afford to the philosophic mind a constantly extending field of speculation, in ranging over which it is next to impossible that he should not encounter new and unexpected principles." Perhaps Chemistry affords more abundant proofs of the truth of these observations than any other branch of Science; for whilst our knowledge of the combinations formed by substances that are usually considered elementary is every day being extended by the labours of the practical chemist,* the discovery of many of the laws which regulate these combinations has not only led to a very simple classification of them—easily understood and remembered—but is constantly pointing to the investigation of new compounds which afford remarkable verifications of their truth. To give a sketch of the present state of our knowledge of these laws, and of some of their more interesting applications, is the object of the present paper.

The elementary or simple bodies, whose existence is now generally recognised, amount to fifty-four: but it is not impossible that their number

* Berzelius has lately published a list of upwards of 4500 of the most important of these combinations, confining himself principally to the *inorganic*.—*Theorie des Proportions Chimiques*, Second Edition, 1835.

may be increased by more extended research; or, on the other hand, that improved modes of analysis may show that several of those now considered simple, may prove to be modifications of one another. They have been arranged by Berzelius in the following order as regards their electrical properties, which are principally deduced from their relative affinities for oxygen. (Op. cit. p. 49.)

Negative Electrics.	14. Tungsten	28. Palladium	42. Cerium
1. Oxygen	15. Boron	29. Mercury	43. Thorium
2. Sulphur	16. Carbon	30. Silver	44. Zirconium
3. Nitrogen	17. Antimony	31. Copper	45. Aluminium
4. Fluorine	18. Tellurium	32. Uranium	46. Yttrium
5. Chlorine	19. Columbium	33. Bismuth	47. Glucinum
6. Bromine	20. Titanium	34. Tin	48. Magnesium
7. Iodine	21. Silicon	35. Lead	49. Calcium
8. Selenium	22. Hydrogen	36. Cadmium	50. Strontium
9. Phosphorus	23. Gold	37. Cobalt	51. Barium
10. Arsenic	24. Osmium	38. Nickel	52. Lithium
11. Chromium	25. Iridium	39. Iron	53. Sodium
12. Vanadium	26. Platinum	40. Zinc	54. Potassium
13. Molybdenum	27. Rhodium	41. Manganese	*Positive Electrics.*

In the opinion of Sir H. Davy, and also of Berzelius, chemical affinity is identical with electric attraction; and whether this view (which is favoured by the recent discoveries of Dr. Faraday) be adopted to its full extent, or not, there can be no doubt that a great connection and correspondence exists between these two forces. When a compound body is decomposed by electric agency, one ingredient is always attracted to the positive pole, and is therefore considered to have electro-negative properties; whilst the other goes to the negative pole, and is considered to be electro-positive. The elementary substances have accordingly been arranged under two classes; the first, or electro-negative, including oxygen and the acids; the second, or electro-positive, comprehending hydrogen and the alkaline bases. But a strong objection arises to such an absolute division, from the fact that most bodies exhibit positive or negative qualities according to the nature of the combinations into which they enter. For instance, sulphur and phosphorus unite as *positive* bodies with oxygen, (which stands at the electro-negative extremity of the scale, and is consequently never positive) so as to form sulphuric and phosphoric acids; but they are the *negative* ingredients of the sulphurets and phosphurets of the metals, which are nearer the positive end of the scale. In general, all substances are positive to those above them, and negative to those below them; but this rule is by no means constant, as the relative strength of affinities is very much affected by temperature and other circumstances. Thus iron has no action upon potash when cold, but at a white heat deprives it of its oxygen, and is

therefore to be considered as at that time *positive* with regard to potassium. Again, mercury is oxidised by contact with the air near its boiling point; but at a higher temperature it loses its affinity for oxygen. Besides this, there seems to be a great difference in the *intensity* of the electric polarity in various bodies; for we see that two bodies usually considered negative, such as sulphur and oxygen, may combine with much greater force than when one of them is positive. Berzelius gives a very ingenious explanation of these facts, which is however too long to be inserted here (Op. cit. p. 56). They show, however, that his table can only be considered as an approximation to the truth; and it is given as such by its author.

The opposite chemical properties of the oxides of these elementary substances were recognised long before the study of their electrical states. All those which are decidedly electro-negative, form acids by combination with oxygen; and all the positive elements form alkaline bases; but there are many substances possessed of no distinct electric characters, whose oxides exhibit acid or alkaline properties according to the quantity of oxygen they contain: and in some cases, the same oxide will vary in its relations according to the nature of the substance with which it combines; a feeble *acid* serving as a *base* to a stronger one, and a feeble base in like manner acting as an acid to one of more decided alkaline properties. Of this nature are the sesquioxides of aluminium and of antimony, the deutoxide of tellurium,—and even water, as will presently appear.

It may here be remarked that the term *acid* is now extended to all those compounds which unite with potash or ammonia, and give rise to bodies similar in their constitution and general character to the salts which the sulphuric, or some admitted acid, forms with those alkalies. In like manner the power of neutralising acids is now considered by chemists as the most characteristic property of *alkalies;* and therefore all those bodies are classed among *alkaline* or *salifiable bases,* which unite definitely with admitted acids, and are capable of forming with them neutral saline combinations. In both these cases the more manifest properties of the body may be concealed by its insolubility, which will prevent its nature from being recognised by the taste, or by test paper.

The compounds which are formed by the union of elementary bodies may be *indefinite* or *definite.* The first division includes those whose elements can apparently unite in any proportion in which they may be mingled,—as alcohol and water: as well as those in which combination occurs in every proportion within a certain limit,—as in the instance of solutions of salts in water, alcohol, &c. Even in these cases, however, the apparent variety of proportion may arise from the mixture or combination of a few definite compounds with each other in various ways.

The most interesting series of compounds is produced by substances which unite in few proportions only; and the laws which have been dis-

covered with respect to them, form one of the most important parts of Chemistry. The following is a summary of them :—

1. The composition of bodies is fixed and invariable. Thus water is *always* formed by 1 part of hydrogen, and 8 of oxygen; sulphuric acid, by 16 of sulphur, and 24 of oxygen; and so on. This law was first established by Wenzel, a German chemist, about the year 1777.

2. There is a constant numerical relation between the proportions in which all bodies combine with each other. The numbers expressing the proportions in which any two bodies unite with a given quantity of a third substance, express also the proportions in which these bodies are disposed to combine with one another. Thus 6 parts of carbon, or 8 of oxygen, will combine with 1 of hydrogen, or with 35·42 of chlorine; and on the other hand, 6 parts of carbon will combine with 8 of oxygen, and 1 of hydrogen with 35·42 of chlorine. These numbers are therefore termed the *combining* or *chemical equivalents* of the respective bodies; and they have been found to correspond exactly with the *electro-chemical* equivalents, deduced by Faraday from the comparative quantities of different substances which are decomposed by the same amount of electricity. The law of chemical equivalents does not apply to elementary substances only, since compound bodies also have their combining proportions, which are always expressed by the sum of those of their constituents. The discovery of this law is principally due to Dalton.

3. When one body unites with another in two or more proportions, their relative quantities bear to each other a very simple ratio; being in almost every instance either as 1 to 1, 2, 3, &c.; or as 1 to $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, &c. The progress of chemical research is rapidly reducing the number of the less simple kinds of compounds, by showing that they may often be considered as combinations of two of the former class. Thus the red oxide of lead, and the black oxide of iron are now viewed somewhat in the light of salts, formed by the union of the peroxides of these metals with their protoxides: and the oxides of manganese afford two, if not three, instances of this kind of combination. We owe the first announcement of this law to Dalton, and its subsequent verification and extension, principally to Berzelius.

The atomic theory of Dalton, which is based upon the foregoing laws, supposes that masses of matter are composed of *atoms* or *indivisible particles*, which differ in weight in different substances, and unite definitely with each other. The number expressing the proportions in which bodies unite, must likewise on this view indicate the relative weights of the atoms; and accordingly these numbers are often called *atomic weights*. Thus, as water is composed of eight parts of oxygen, and one of hydrogen, it follows, on the supposition of its consisting of one atom of each element, that an atom of oxygen must be eight times heavier than one of hydrogen. This view, however, being entirely theoretical, must not be confounded

with the laws of definite proportion, which are directly deduced from experiment.

When the *volume* of *gases* is compared with their equivalent weights, it has been shown by Gay Lussac, that there is a very simple ratio between them all. The combining equivalents of hydrogen, nitrogen, chlorine, and cyanogen, for example, are 1, 14·15, 35·42, and 26·39 respectfully; but when these different weights are measured, they are found to occupy exactly the same space; a similar quantity of ammonia or of binoxide of nitrogen possesses double the volume; and of oxygen, only half. This fact is usually referred to under the title of the *Theory of Volumes;* and it has been shown, that the combining volumes of substances in the state of gas or vapour, whether elementary or compound, are either equal, or have the simple ratio of 1 to 1, 2, 3, &c. It thus appears that the laws of combination may be deduced as well from the volumes as from the weights of the combining substances; and this may now be regarded as one of the best established laws in Chemistry.

In investigating the composition of inorganic substances, we always find them made up of *binary* compounds. Thus sulphuric acid is formed by sulphur and oxygen, and potash by potassium and oxygen. Each of these is a binary combination; and the two may unite to form a double binary or *quaternary* compound, sulphate of potash, which is termed a salt. This, although apparently neutral, has electro-positive properties, and will combine as a *base* with a similar combination, viz. sulphate of alumina, forming with it a double salt, familiarly known as alum.

The two great classes of *acids* and *alkalies,* formed by the union of oxygen with other elementary bodies, were long considered as the only combinations to which these terms could be applied, and by which salts could be formed; but later researches in chemistry have shown that sulphur, chlorine, iodine, bromine, fluorine, the compound body cyanogen, and probably some other substances, are capable of forming combinations which deserve the terms *acid* and *base,* and which produce distinct *salts* by their union. Thus the proto-sulphurets of electro-positive metals, termed *sulphur-bases,* correspond to the alkaline bases of those metals formed by their union with oxygen; and they combine with the sulphurets of electro-positive substances, or *sulphur-acids,* which are analogous in composition to the acids which the same substances produce by union with oxygen. Hence, if the sulphur of a *sulphur-salt* be replaced by an equivalent quantity of oxygen, an *oxysalt* is the result. Thus the bisulphuret of carbon, or the sesquisulphuret of arsenic, form a salt with sulphuret of potassium, which, by the substitution of oxygen for sulphur in each ingredient, would form carbonate or arsenite of potash.

The gradual development of facts of this kind, principally by the researches of Berzelius, has caused the extension of the term *salt* to all the

quaternary combinations formed by the substances before mentioned; and they are susceptible of a very simple classification.

I. The oxy-salts. In all of these, with the exception of the compounds of ammonia, both acids and bases contain oxygen. They may be typified by sulphate of potash.

II. The hydro-salts. This order is limited by Dr. Turner to those salts in which both the acid and the base contain hydrogen, and in which oxygen does not exist. The only examples of this kind of composition are the combinations of the hydracids with ammonia, and with phosphuretted hydrogen.

III. The sulphur-salts. The composition of these has been already explained.

IV. The haloid salts. These are analogous in composition to sulphur salts, being formed by the union of the chlorides, iodides, bromides, fluorides, and cyanurets, of different elementary substances with each other.* Their composition may be illustrated by that of the ferro-cyanuret of potassium (commonly called prussiate of potash), which consists of cyanuret of iron, as a haloid acid, combined with cyanuret of potassium, which acts as its base. Under this class some very curious combinations occur, in which it appears that substances having most decided *acid* properties, such as the hydriodic, hydrosulphuric, hydrocyanic, and even the hydrochloric (muriatic) acids, act as electropositive elements or *bases* to the chlorides, iodides, &c. of platinum and other metals.

Not only do the combinations of oxygen, cyanogen, &c. with *different* bodies, unite to form salts, but even their different combinations with the same body. Thus, chromic acid (1 chromium, 3 oxygen) will unite with the sesquioxide of chromium (1 chr. $1\frac{1}{2}$ ox.); tungstic acid with oxide of tungsten; sesquioxide of iron with the protoxide, to form the black oxide; and sesquicyanuret of iron with the protocyanuret, to form prussian blue. It is only very recently that the composition of the latter substance has been satisfactorily ascertained. In like manner, the oxide of a metal will occasionally unite with its chloride, iodide, &c. forming *oxy-chlorides*, oxy-iodides, &c. Interesting examples of such compounds are afforded by the pigment known as Brunswick green, which is an oxy-chloride of copper,—the same substance which is generated during the corrosion of copper in sea water; and by the mineral or patent yellow, which is an oxy-chloride of lead.

Some of the elementary substances, and a great proportion of the various orders of compounds, are usually obtained in a crystalline form. The

* The term haloid salts is here employed in the sense in which it is used by Bonsdorff (Annales de Chimie, xliv. 189), and copied from him by Dr. Turner (Elements of Chemistry, p. 669), differing from its application by Berzelius, who includes under it the simple or bi-elementary chlorides, iodides, &c.

condition generally requisite for this process, is the slow and gradual change from the fluid to the solid state; the arrangement of the particles being at the same time undisturbed by external motion. Thus sulphur, or bismuth, assumes a crystalline form, when slowly cooling from a fused mass; and saline substances are deposited in crystals by the spontaneous evaporation of their solutions, or by the cooling of solutions saturated at the boiling point. It has, however, been recently discovered, that some solids can undergo a change in the form of their crystals, without being reduced to a fluid state. A great variety of external form prevails amongst crystals of different substances; and the study of them has now become so extended, as to form a distinct science, termed Crystallography, of which a few of the leading principles may be here stated.

It was pointed out by Hauy, that in every crystal there is a *primitive* form, or nucleus, which may be procured by cleaving it in the direction of its laminæ; and that this is susceptible of modification into various *secondary* forms, geometrically allied to it, in one or other of which the crystal may occur. Thus the cube is easily convertible into the octohedron, tetrahedron, or rhombic dodecahedron; the six-sided prism is allied to the six-sided pyramid, and so on. On these views is founded the classification of Mohs, who arranges all the forms of crystals under six systems, with which it is important for the chemist to be acquainted, as the various forms which a salt or any substance may resume, almost always belong to the same system. It was considered until lately, that the primitive form was constant in each substance; but late observation has shown that sulphur, and probably other bodies, are capable of affording two varieties of crystals, whose primary forms are incompatible with one another. Such substances are said to be *dimorphous*. Notwithstanding the general correspondence in form, there is so much difference in the proportions of the sides and angles of crystals of different substances, that most salts have one or more forms peculiar to themselves; and identity of form was formerly thought to indicate, in most cases, similarity of composition. But in 1819, it was discovered by Mitscherlich of Berlin, that certain substances have the power of assuming the same crystalline form, and may be substituted for one another in combination, without affecting the external character of the compound. Such substances are said to be *isomorphous;* and several distinct groups have been already described. One of the most remarkable of these includes the salts of arsenic and phosphoric acids, which will be presently adverted to more particularly; another contains the salts of sulphuric, selenic, chromic, and manganic acids; and in another are included the sesquioxides of aluminium, iron, chromium, and manganese. Several other groups might be enumerated, did space permit. In comparing together isomorphous bodies of the same group, we are not to expect identity of form, unless there is similarity of composition. The variety which may be produced in the constitution of

alum affords an interesting example of these properties. The alumina may be replaced by the sesquioxides of iron, chromium, or manganese; ammonia may be substituted for the potash; and selenic, chromic, or manganic acids for the sulphuric; so that the composition of this salt may be partly or entirely changed, without its external form being affected. Isomorphous substances have often very close points of resemblance independent of form: thus arsenic and phosphorus have the same odour, they both form gaseous compounds with hydrogen, they differ from nearly all other bodies in their mode of combining with oxygen, but agree with one another, and their salts are disposed to combine with the same quantity of water of crystallization. A similar analogy exists between sulphur and selenium, baryta and strontia, lime and magnesia, cobalt and nickel.

Another interesting discovery of recent date is, that the same elements uniting in the same ratio, may give rise to compounds differing in external form and in chemical properties: to such the term *isomeric* has been applied. Interesting examples of this fact are afforded by the two cyanic acids, one of which has been termed *fulminic*, from its giving rise to powerfully detonating compounds; also by the tartaric and paratartaric acids; and it has been shown that the animal product *urea*, and the cyanide of ammonia, produced by artificial means, are, in like manner, isomeric. "Unexpected as was the discovery of isomerism," says Dr. Turner (p. 238), "it is quite consistent with our theories of chemical union, insomuch as the same elements may be grouped or combined in different ways, and thereby give rise to compounds essentially distinct."

The compounds of *water* have, until lately, been very little investigated; for it is only since the establishment of the laws of definite proportion, that chemists have been led to perceive that it has a share in the atomic constitution of various substances, as important as that of any other binary combination. In some instances, it appears to unite with other bodies in a variable ratio, as in solutions of salts, or combinations with acids, alcohol, &c.; but, as Dr. Turner observes, "in all such compounds, the elements are united by a feeble affinity, and preserve, when combined, more or less of the properties which they possess in a separate state." In other cases, water unites with various substances in certain fixed proportions; and this class of compounds may be divided into two;—in the first, water is essential to the constitution of the body, acting as a direct chemical agent; whilst in the second, it appears merely requisite to enable certain compounds to assume their regular crystalline forms, and is therefore termed water of crystallization.

Respecting the indefinite combinations of water, there is little more known than what has been already stated, with regard to the class to which it belongs; but, with regard to its definite combinations, several remarkable facts have been recently ascertained, which deserve notice.

Water bears a very striking analogy to some of the metallic oxides,

which have been already alluded to; for, whilst in some instances it acts as a base to acids, it appears to hold the relation of an acid to most of the salifiable bases, and forms with them quaternary compounds, which may fairly be considered as salts. This view is confirmed by the fact, that if a hydrate be decomposed by the voltaic battery, the base is found at the negative pole, whilst the water passes to the positive. Its affinity for the pure alkalies is so strong, that no degree of heat will drive it off; and, though most of the earths may be obtained free from it, a very considerable elevation of temperature takes place during their combination with it, as is seen every day in the slaking of lime. For the other metallic oxides, its affinity is very variable, but in most cases less forcible. It is the opinion of Berzelius, that the quantity of oxygen in the water of a hydrate is the same as that which exists in the oxide with which it combines; so that a protoxide will combine with one atom of water, a deutoxide with two, and so on. If this opinion be correct, it shows another strong analogy between the hydrates and other compounds acknowledged as salts. Many other combinations of the metals with sulphur, chlorine, iodine, cyanogen, &c. have a greater or less affinity for water. A familiar example of this is afforded by the blue and green sympathetic inks, which are composed of the chlorides of cobalt and nickel: both of these compounds are of a pale colour when in the state of hydrate; but if the water be driven off by a moderate degree of heat, their colour is rendered much brighter, but fades again by the absorption of water as they cool.

The combinations of water with acids, as a salifiable base, have been investigated as yet in a few cases only; but the results already obtained, principally by Mr. Graham, are very interesting, and open a new path for investigation. It has been shown that phosphoric acid cannot be obtained except in combination with three equivalents of water, which is termed *basic*, and which may be wholly or partly replaced by other salifiable bases. On exposing this compound to heat, one atom of water is driven off, and an acid remains, having the same proportions of phosphorus and oxygen as exist in phosphoric acid, but combined with only two equivalents of water, and altered in several of its chemical relations; this, which is termed paraphosphoric acid, being exposed to a still higher temperature, is converted by the loss of another atom of water into metaphosphoric acid, which differs in its properties from the two former, but retains the same atomic constitution. These three acids are therefore *isomeric;* the first throws down a yellow precipitate with oxide of silver, and has a tendency to unite with three atoms of water, or an alkaline base; the second gives a snow white granular precipitate, and combines with two atoms of a base; the third produces a gelatinous precipitate, and unites with only one atom of a base. Arsenic and telluric acids have a tendency to form combinations similar to those of phosphoric acid; and the ordinary con-

centrated sulphuric acid is a compound of real acid and one equivalent of basic water, which cannot be separated without great difficulty.

From these facts it is evident that a certain part of the water, entering into the constitution of salts formed by these acids, must be considered as *basic;* whilst the rest is merely necessary to enable the salt to assume its crystalline form. Thus crystallized sulphate of zinc contains seven equivalents of water, of which six may be easily driven off, but one equivalent remains in combination at 410° and all inferior temperatures. This salt may therefore be considered as a double sulphate of oxide of zinc and water, with six equivalents of water of crystallization. The atom of basic water may be replaced by one of sulphate of potassa, so as to form a true double salt, without any change in external form; and this fact appears to form a clue to the tendency of this sulphate, and others of similar constitution, to form double sulphates. Again, plaster of Paris appears to consist of a sulphate of lime, and two equivalents of basic water. At a temperature not exceeding 270° this salt loses its water, but retains the power of recombining with it, or *setting;* but if heated above 300° it becomes properly sulphate of lime, and loses the tendency to recombine with water,—a change perfectly analogous with that of a phosphate to a paraphosphate.

It is in the constitution of the salts of phosphoric and arsenic acid, which are isomorphous, that the most striking facts of this kind may be observed. As was just now stated, these acids have a tendency to combine with three equivalents of water, or of an alkaline base, so as to form salts. By substituting one atom of soda for one of basic water, we obtain a salt called the *acid* triphosphate of soda, as the acid is not neutralized by the alkali. If another atom of water be exchanged for one of soda, a *neutral* triphosphate is obtained, which is the most frequent combination; and if the whole of the water be replaced by soda, an *alkaline* triphosphate is produced. Both the acid and neutral triphosphates may be converted into paraphosphates by heat; and double salts may be easily formed by substituting one base for part of the water, and another base for the rest.

All these salts require a certain quantity of water of crystallization, to enable them to assume their regular forms; and it is remarkable that the neutral triphosphate usually crystallizes in one form—the common rhombic phosphate—with 24 equiv. of water; but that when its solution is evaporated at a temperature of 90°, a different set of crystals is produced, having only 14 equiv. of water. These are the two salts to which Sir J. Herschel refers, when speaking of the laws of isomorphism (Prelim. Disc. p. 170), and combinations precisely analogous are formed by arsenic acid.

The quantity of combined water is very variable in different salts, but uniform in the same, except in cases analogous to the one just mentioned. A salt may contain double its own weight of water, and yet be perfectly dry; but on exposure to heat, it is dissolved in its own water, undergoing

what is termed watery fusion. By a strong heat all salts lose their water of crystallization. Some salts, in crystallizing, enclose mechanically within their texture particles of water; by the expansion of which, when heated, the salt is burst with a crackling noise into smaller fragments; this occurrence is termed decrepitation. Καππα.

SOME ACCOUNT OF THE MER-DE-GLACE.

August, 1831.

———With respect to my own observations upon the Mer-de-Glace, they were necessarily somewhat meagre, as I paid but a short visit to Chamouni; I will therefore be better than my word, and add to the account of what I have observed for myself, that which I have learned from De Saussure, an author a little out of date in England, but whom, nevertheless, every Alpine traveller will do well to study attentively.

With Geneva you are acquainted: I do not remember any thing tolerably new there, excepting the wire bridges over the fossè, and Davy's monument in the Protestant burying-ground. The monument is plain and in very good taste: I copied the inscription for you,—here it is:

Hic jacet
Humphry Davy,
Eques, Magnæ Brittaniæ Baronettus,
Olim Regiæ Societ. Londin. Præses,
'Summus arcanorum Naturæ indagator.'
Natus Penzantiæ Cornubiensum xviii Decemb. mdcclxxviii.
Obiit Genevæ Helvetorum xxix Mai mdcccxxix.

Having sent our heavy baggage round by the lake to meet us at Martigny, we got under weigh at five o'clock in the morning for Chamouni. We went as far as St. Martin in an open carriage, which our party there exchanged for a char-au-banc; however, H——y and I preferred walking, which we did, with the exception of a mile or two, all the rest of the way; and a very fine walk we had: we arrived at Chamouni just after dark.

Next morning by day-break we ascended the Montagne-Vert, where we will, if you please, pause while I give you an aperçu of what we came to see. You must know that parallel to the central chain of the Alps, and running, therefore, east and west, or nearly so, are certain valleys, of which Chamouni is a principal one; which valleys open laterally to receive certain smaller valleys or, as we should say, combes, which descend from the summits of the great Alpine chain. In these combes lie the principal glaciers, extending from their gradual commencement near the summit of the mountains, to their sudden termination on the edge of the principal valley, a distance, in some cases, of eight or ten leagues.

The sides of the hollow occupied by the Mer-de-Glace are excessively high and steep; and its embouchure, a little to the east of the village of Chamouni, is flanked by two mountains loftier than the rest, upon the

western of which, the Montagne-Vert, we stood; while the peaks of the other, called most appropriately "Les Aiguilles," rise upon the opposite side. At some distance above its termination, the glacier divides into two branches, which descend from different faces of the mountain.

Leaving the rest of the party to proceed with the guide along the bank of the Mer towards the Jardin, I descended the side of the mountain to obtain a nearer view of the glacier. This was speedily effected, for having slid down a steep bank of ice, I found myself in a situation out of which it seemed easier to advance than to retreat. I determined therefore to gain the other side, thinking the feat to be a very simple one, and likely to give a fine view of the glacier.

After having proceeded about a furlong, slipping down occasional declivities in the ice, I found myself fairly in the substance of the glacier, and in no very enviable position. The ice lies, or rather stands, in large flakes called '*glacons*,' which rest one upon another like a pack of cards, and dip nearly vertically up the valley. Between these *glacons* are a number of chasms, some of which are above a hundred feet deep, and half full of water. My principal object was to keep upon the crest of the thickest *glacon* I could get at; and taking care not to fall into the fissure on the left, or slide into that on my right, thus to scramble on all fours towards the opposite side. This process was not very difficult, as the crest of the *glacon* was rough, and at least a couple of feet thick; but it was every now and then intersected by smaller fissures, across which it was necessary to pass. This was performed by descending twelve or fourteen feet on the back of the *glacon*, until the fissure became narrow enough to be crossed, and so climbing up again on the other side. This was not very hazardous, as I had a bâton Suisse of about six feet long, well shod and spiked with iron at one end, and armed with a Chamois horn at the other, by striking which well into the top of the *glacon*, a firm stay was ensured.

After more than an hour's scrambling, I arrived at the *Moraine*, a huge ridge of stones, composed of blocks of many tons weight, piled up together in utter confusion, and forming a ridge of five and twenty feet high, which extends along parallel to the glacier, on the edge of which it lies. There were two or three of these ridges, over which I passed, much preferring them to the ice; and at last I fairly reached the mountain on the opposite side; and here I paused to take breath and enjoy in safety the scene around me, which was certainly grand in the extreme.

The materials of the Moraine seem to be derived from the various mountains passed by the glacier in its course; some of the blocks lying on the ice itself, others only reaching to its verge. The piles before me were not I think much above twenty feet in height; but they are said in this very glacier to be in some places thirty or forty, which indeed is not at all improbable, as the same causes that produced act also to increase them as they descend. The blocks are said to be detached chiefly during the

spring or wet season, and to be carried irregularly forwards by the progressive motion of the glacier.

I did not care to repass the glacier by my old route, even had it been practicable, neither did I wish to descend into the valley without examining the ice a little higher up; so I coasted along the side of Les Aiguilles, until the ice appeared to be smoother, and then recrossing the Moraine, found myself once more on the glacier. The surface here was tolerably level and not at all slippery, partly owing to the bubbles and broken flaws in the ice, and partly from a sort of rough crust by which it was in many places covered. Upon this ice, which was as safe and pleasant walking as a London pavement, I loitered half way across the glacier, until it became, though still level, intersected by fissures varying in width up to about eight or ten feet, and of a considerable depth, and the rain began to fall sharply. Some of these fissures it was easy to leap over, so secure was the footing; others I followed until they narrowed or ceased altogether, and one very broad one was crossed by a snow bridge. Just as the misty rain and the dusk of evening began to render my path an unpleasant one, and to make me rather feelingly attentive to the occasional crash of the falling ice, I heard a halloo some way up the glacier, and after a few minutes met the guide, to our mutual satisfaction, for he it seemed had been guilty of great neglect, in not warning a stranger of the folly of attempting so dangerous a route.

We left the glacier together, and he led the way along a mountain path. The mountains on the western side of the glacier are slaty, and dip under the ice at about 70°; so that the weather, stripping off some of the upper beds, had formed a narrow ledge, not above a foot wide but very safe, owing to the inclination of the mountain. While we were upon this path, a flock of goats joined us, and not a little annoyed me by treading on my heels, and threatening to trip me up where a fall would have been fatal.

All along this side of the glacier the ice had melted away from the rock, and left a shelving cavity between, shewing the fallacy of that theory which supposed the glaciers to be the product of a congelation carried on during the summer nights in the valleys, whereas the contrary is evidently the true state of the case. It is indeed now well known, that, independently of the effect of the sun's rays on the surface of the ice, which is considerable, that part of it which is in contact with the soil is constantly melting, and contributes chiefly to those perpetual streams which flow forth at the mouth of every glacier. Were this not the case, there seems reason to apprehend that the glaciers would be continually on the increase, and finally take possession both of the primary and secondary valleys of the great Alpine chain.

This path led us, just after dark, to the cottage on the summit of the mountain, and thence I reached Chamouni in about twenty minutes, wet through and rather tired, but with no ailment that was not effectually removed by a good supper and a few hours' sleep.

ON THE PRACTICABILITY AND ADVANTAGES OF A COMMUNICATION BETWEEN THE ATLANTIC AND PACIFIC OCEANS, ACROSS THE ISTHMUS OF CENTRAL AMERICA.

BY W. HAMILTON, M. B.

Almost from the earliest period of its discovery, the isthmus of Darien or Panama, which connects the two vast continents of North and South America, attracted the notice of the commercial world, as offering the greatest facilities for opening a communication between the two seas, and thus facilitating the intercourse of Europe with the East.

Of the various projects to which this gave birth, it will be sufficient to notice the memorable plan of a Scotch clergyman of the name of Paterson,* who having made himself master of all the geographical features of the isthmus, and of the seas on either side of it, projected the formation of a settlement on this hitherto neglected spot, with the view of making it the centre of communication between the shores of Asia and of Europe. On the causes which led to the failure of this valuable project, and the intrigues which were employed for its overthrow, it would be needless now to dwell. It will be sufficient to observe that its failure is to be sought for, not in any physical obstacles tending to render it impracticable, but in the selfish conduct of those who imagined its success would be prejudicial to their interest; and the unaccountable blindness of those who had the power of securing its success.

Since the period at which these attempts were made, the progress of knowledge has tended to induce a more correct judgment as to their true interests in the minds of men; and the improved circumstances of the Spanish settlements offer peculiar facilities for the accomplishment of this project. The government of New Granada, having at length, after the storms and anarchy of revolutionary struggles, acquired something like a consistency, and directing its serious attention to the improvement of the internal resources of the country, has not overlooked the enormous advantages which may be expected to result from opening a vast commercial thoroughfare through its territories; turning the tide of wealth in its onward course from Asia to Europe, into a new channel across the isthmus of Darien, or the northern part of the province of Chocò, rich in subterranean wealth, and abounding in vegetable treasures.

Humboldt has discussed the problem of the communication between the two seas with his usual ability, and has thrown upon the subject all the concentrated light which his various sources of information placed within

* See Dalrymple's Memoirs of Great Britain and Ireland, vol. ii.

his reach; but from the deficiency of those sources, and the unavoidable imperfection of that information for which he was dependent upon the veracity of others, his statements are not in all respects to be depended upon; and at all events, from the length of time which has elaped since the publication of his remarks, some corrections have become necessary. According to this able writer, the points which have been at various times selected for attempting a communication between the two seas, are five in number, of which two are situated in the dominions of Mexico, to the west of the eighty-third degree of west longitude; and three to the east of that meridian, within the territories of the republic of New Granada. These points are as follows:—

To the West of the Meridian of 83° W. L.

1. The isthmus of *Tehuantepee*, between the sources of the *Chimalapa* and *Rio de Passo*, which falls into the *Rio Huasacualco*, between the parallels of .. 16° & 18°
2. The isthmus of *Nicaragua*, between the port of *San Juan de Nicaragua*, and the coast of the gulf of *Papagayo*, near the insulated volcanoes of *Granada* and *Bombacho*, between the parallels of .. 10° & 12°

To the East of the Meridian of 83° W. L.

1. The isthmus* of *Panamà*, between the parallels of ..... 8° 15′ and 9° 36′
2. The isthmus of *Darien* or *Cupicà*, between the *Rio Napipi* and the bay of *Cupicà*, on the west coast of the Chocò, between the parallels of ..... 7° and 8°
3. The *Canal of Baspadura*, between the upper part of the *Rio Atrato* and *Rio San Juan de Chocò*, between the parallels of 4° 58′ and 5° 20′

The object of this hasty sketch being only to show the advantages of one or two particular points, to which it is desired to call the attention of the commercial world, it would be inconsistent with the brevity to which it is confined, to enter into any examination of the merits or the demerits of the other points. It will, therefore, be sufficient to observe, that from a most careful consideration of the subject, the two points indicated in the Mexican territories present obstacles to the completion of the project, which appear to the writer to be insurmountable; while of the three situated within the jurisdiction of New Granada, but one of the three points

* This isthmus contains, in fact, no less than three distinct lines for the proposed communications, namely, between *Cruces* and the town of Panamà; between the *Ensenada de Mandinga*, to the east of the *Punta de San Blas*, and the *Rio San Juan Diaz*; and between the *Ensenada de Anachichima* and the *Golfo de San Miguel*. Of these, however, the latter alone appears to merit attention.

indicated in the note as belonging to the isthmus of *Panamà,* and that across the isthmus of *Cupicà,* appear to be possessed of the requisite advantages. With respect, indeed, to the lines of communication formed between the northern coast of the isthmus of *Panamà* and the southern shores of the bay of that name, we have sufficient arguments against them in the testimony of Humboldt himself; who, while advocating the construction of a canal in this direction, admits that the bottom of the bay is so shallow, that "a canal issuing at Panamà would require to be carried out into the sea to a distance of *at least two leagues,* in consequence of the shallowness of the water, as far as the isles of *Flamingo* and *Perico,* the depth to this distance not exceeding a few feet."*

Independent, however, of the objections arising from this want of depth of water in the bottom of the bay, which precludes not only the approach of ships of burthen, but even of any other than flat-bottomed boats; the elevation of the ridge of partition, which traverses the isthmus as far as the right bank of the river *Chuchunque* or *Tuyra,* which falls into the head of the gulph of St. Michael, opposes obstacles the existence of which Humboldt does not question, although he labours to diminish their amount.

The first point, therefore, which appears to present the fewest and least formidable obstacles, is that between the *gulph of St. Michael* and the *Ensenada di Anachachuna,* already spoken of.

The ridge of partition, the elevation of which has unfortunately been in no one place determined, either by barometical or geodesical measurement, after following a direction nearly parallel to the shores of the bay, a little to the east of the seventy-eighth degree of longitude west of Greenwich, abruptly terminates on the northern bank of the river *Tuyra,* at the head of the gulph of St. Michael; leaving a tract of perfectly level country, for the space of more than one degree of latitude from north to south. Following the river *Tuyra* from the point of its junction with the gulph, in its south-eastern angle, as it coasts the southern termination of the ridge of partition, we come to a division of its waters; one branch of which comes from the south-east, while the other follows the course of the ridge, washing the base of its eastern and northern slope, till it approaches within an apparently short distance of the northern coast, a little to the west of Cape Tiburon.

Were it practicable to connect this river by a canal or rail-road with the Carribean sea, and to render its channel navigable for vessels of moderate burthen into the gulph of St. Michael; this would be in many respects the most eligible point of communication, which could be desired: but in the absence of all accurate surveys of this part of the country, and every thing like data even for hypothesis, it is impossible to do more at present than indicate this as a point of considerable promise, and one well worth the expense and trouble of an accurate survey.

* Personal Narrative, vol. vi. p. 240, note.

Quitting this, which may perhaps be regarded as debateable ground, we next arrive at the narrow tract of level ground interposed between the upper part of the little river Napipi, a tributary of the Atrato, and the bay* of Cupicà on the coast of the Pacific. Here our information is somewhat more precise, as well as more recent; and here, if any where, from all the evidence obtained both from the researches of Humboldt, and the communications of private correspondents, the obstacles to the formation of a communication between the two seas appear to be reduced to their minimum. From the right or northern bank of the Rio Tuyra, to the northern termination of the littoral branch of the chain which traverses the Chocò, the ridge of the Andes, as has been already observed, wholly disappears, leaving a tract of country which consists, according to Humboldt, upon the authority of Don Ignacia di Pombo, a merchant of Carthagena, deeply interested in every thing which regarded the statistics of New Granada, of a perfect plain *(tereno enteramente Hanos)*† interrupted, as a correspondent at Carthagena in a letter of the 24th of January, 1835, states as the result of minute inquiries, by only one small hill of trifling elevation. Hence the difficulty of establishing a line of communication between the nearest point of the Napipi and the bay of Cupicà, either by a canal or by a rail-road, must arise more from the distance between these two points, than from any obstacles of surface.

In the absence of all positive and precise information respecting the geographical positions of the several points, and their mutual bearings, it is impossible to do more than give an approximate estimate of distances.

In the map of Columbia, prefixed to the sixth volume of Humboldt's Personal Narrative, the scale of which, however, is too small for accurate calculations, the nearest point of the Napipi appears to be in 7° 22′ of north latitude, and 77° 20′ of west longitude; while the nearest point of the Rio Cupicà is in 7° 20′ north latitude, and 77° 32′ west longitude, giving a difference of two minutes of latitude, and twelve minutes of longitude, or about twelve marine miles and eleven hundredth parts, equal to a little more than fourteen English miles, for the distance between these two points. Humboldt, in the extract of the letter from Carthagena, already referred to, fixes the distance at from five to six leagues; while an article inserted

* "I have not seen the port of Cupicà marked in any Spanish map, but have found *Puerto Quimodo ò Tupica*, at 7° 15′ lat. *(Carta del Mar de las Antillas*, 1805. *Carta de la Costa Occidental de la America*, 1810.) A manuscript sketch in my possession, of the province of Chocò, confounds Cupicà and Rio Sabaletta, lat. 6° 30′; yet Rio Sabaletta is placed in the maps of the *Deposito* south and not north of Cape Francisco Solano, consequently 45′ south of Puerto Quemado. According to the map of the province of Carthagena, by Don Vincensi, Lond. 1816, the confluence of the Rio Napipi (Naipi?) is 6° 40′ lat. It is to be hoped that these uncertainties of position will soon be removed by observations taken on the spot." Pers. Narr. vol. vi. p. 249, note.

† Pers. Narr. vol. vi. p. 251.

in the *Reverberacion Mercantil del Atrato,* of the 20th of May, 1834, published at Quibdo, the capital of the Chocò, informs us, that "the Napipi does not offer so good a navigation as the Atrato, higher than five leagues from its mouth; this decreases naturally in its ascent, so that it ceases at length to be navigable at the Tando de Antado, about twelve leagues above its mouth; but its waters continue flowing towards the Pacific, to within two leagues and a half of the bay of Cupicà." Hence we may take two English miles as the fair average distance between the nearest navigable points on each side: that this is not too small an estimate will farther appear from the length of time required to traverse the distance, and the obstacles presented to travelling over an uncleared track, destitute of even the semblance of a pathway. Humboldt* informs us that the first person who called the attention of the Spanish government to this point, was a Biscayan pilot of the name of Gogueneche, in the year 1799; and he adds, that "persons worthy of credit, who had made the passage with him from the Pacific sea to the embarcadere of Naipi, assured me that they saw NO HILL in that isthmus of alluvial earth, which they were ten hours in crossing." The article already quoted from the Quibdo paper informs us, that "from the point of Antado to this bay (Cupicà), a man generally goes on foot in six or seven hours," remarking very properly, that "it should, however, be borne in mind, that this journey is performed along a part which eludes the eye of the inexperienced traveller, and requires the practiced scrutiny of the Indian to detect. Throughout the whole of the tract which divides the Atrato from the Pacific in this direction," continues our Quibdo authority, "the soil is naturally dry, fertile, and low, interrupted only by a few mounds; so that an excellent road might be made at a trifling cost."

The Carthagena correspondent already quoted, in his letter of the 24th of January, 1835, states that the Indians cross this isthmus on foot with a load of cocoa nuts and other articles on their backs four times a day, making two trips; from all which it is evident that the direct distance cannot vary much from what has been stated; that by deepening the Napipi, and improving its navigation beyond the *Tando de Antado,* this direct distance might be farther considerably shortened; and that the obstacles to the formation of a road are not greater than are every day encountered in the formation of turnpike roads in England.

In confirmation of this view of the case, we have the evidence of the singular but successful expedition performed by this route, in the beginning of the year 1820, by Colonel Cancino, an officer in the service of the South American patriots, accompanied by Captain Joaquim Andrade, the surgeon of the patriot frigate Andes, and another individual of the name of Deserein. From the article in the Quibdo paper, it appears that the Spaniards having concentrated their forces towards the interior of New Granada, and

* Pers. Narr. vol. vi. p. 250.

invaded the Chocò by water, with the troops drawn from Carthagena in the month of January, 1820; Colonel Cancino, who had the command of the province, receiving intelligence of the circumstance while at the port of Buenaventura, where the Andes frigate, Captain (now Admiral) John Illingworth, was then lying, resolved on taking the enemy in flank. Embarking with this view on board the Andes, he proceeded to the bay of Cupicà, where he had the frigate's six-oared launch sent ashore, and dragged across the isthmus to the Napipi, which was accomplished by manual labour in the space of ten hours, notwithstanding the delay occasioned by being obliged to cut a way through the woods. On reaching the banks of the Napipi, the boat was launched anew, aad the party re-embarking descended the Napipi, and ascended the Atrato as far as Quibdo, in time for Colonel Cancino to execute his daring and masterly project of taking the enemy by surprise, at a time when they did not conceive it within the compass of human possibility for him to be near them. The writer of the article in question further adds, that the boat in which this important expedition was performed, remained at Quibdo for many years after the event, and fell to pieces under the eyes of all the inhabitants. The circumstance was perfectly well known, and at the time of his writing both Colonel Cancino and Captain (now Admiral) Illingworth were to his personal knowledge living witnesses of the fact.

With the evidence of these two instances, resting upon authority which hardly admits of being questioned, before us, all doubt of the practicability of establishing a communication between the two seas at this point disappears; and the chief objects of inquiry which remain, are those which regard the navigation of the Atrato and the Napipi.

The distance from Carthagena to the mouth of the Atrato usually occupies two days in the small coasting vessels of the country, whence it takes them six days, during the season from January to March, when strong sea breezes prevail from the north-east, to ascend the Atrato as far as its confluence with the Napipi. The ascent to the source of the Napipi occupies, in the boats of the country, only three days.

The Atrato discharges itself into the bottom of the gulph of Darien by a number of mouths, forming a marshy delta covered with woods, and subject to frequent inundations. Of these mouths or channels, that called Barbacoas is the most frequented; and has at its entrance from the deep and extensive bay of Candelaria, a depth of from six to eight feet of water at its lowest ebb. Within this bar, which not improbably admits of great improvement, the river is of sufficient depth for vessels of the greatest draught. This bar is said to be wholly formed of the deposit of the river,—mud and rushes, and consequently easily susceptible of being removed—in which even merchant ships of the largest size might sail up the Atrato, as far as the confluence of the Napipi. This point Humboldt* places at

* Pers. Narr. vol. vi. p. 250.

fifteen leagues above the mouth of the Atrato, while the article in the Quibdo paper says, that "from Candelaria to the mouth of the Napipi, following the windings of the Atrato, there are about sixty leagues, of twenty to the degree."* Which of these is the correct statement, it would be difficult to determine in the present state of our knowledge. The writer of the Quibdo article, who may be presumed to speak from a personal knowledge of the Atrato, informs us that from the bay of Candelaria up to the town of Quibdo, there is not the slightest obstacle to its navigation, in vessels of thirty tons; and he adds, that "were it not for the shallows at the mouth of the river, vessels of any size could come up to this city† (Quibdo) with perfect safety." With respect to the velocity of the current, which he says is always the same in every part of the river, our Quibdo authority fixes it at only two miles per hour—a velocity which marks a very trifling slope indeed in the bed of the river. In the letter from Carthagena already quoted, the breadth of the Napipi at its confluence with the Atrato is said not to exceed three hundred feet; and its depth of water is said to be only sufficient for the boats of the country called *ranchados*, which are a kind of large canoe, varying in length from thirty to forty feet, but only drawing from eight to nine inches of water. These boats take three days to ascend the river, from its mouth to the disembarcadere, or landing place: its current, like that of the Atrato, is said to be extremely slow, marking a country of little if any ascent.

The Atrato is formed by the confluence of three small rivers, the Andagada, Quibdo, and Zitarà (or Citarà)‡, which have their sources in a little mountain situated nearly in the sixth parallel of latitude. The junction of these rivers takes place at no great distance from the capital of the province, and their united waters flow, under the name of the Atrato, nearly in a straight line from north to south, through a narrow valley flanked by two mountain ridges of great elevation, whose sides are clothed with perennial woods, and drenched for three fourths of the year with almost incessant rains: in a course of about one hundred and fifty miles, it receives in succession the tributary waters of several considerable streams; among which may be noticed, on the right the Bavara§ and the Murry,‖ and on the left, flowing from the direction of the coast, the Napipi.¶ Further on, its waters receive a still greater addition, from their junction with those of the Sucio, which

* Reverberacion Mercantil del Atrato, 20 Mayo, 1834.

† A distance of 114 marine leagues, or 342 sea miles, equal to about 396 English miles of 69½ to a degree of latitude.

‡ It is from the two latter of these rivers, that the capital of the Chocò is indifferently termed Quibdò or Citarà.

§ Latitude 6° 47′, longitude 76° 50′.

‖ Latitude 7° 05′, longitude 76° 50′.

¶ The position of the confluence of this river with the Atrato is uncertain, but is placed in Humboldt's map in latitude 7° 28′, and longitude 77° 00′ west of Greenwich.

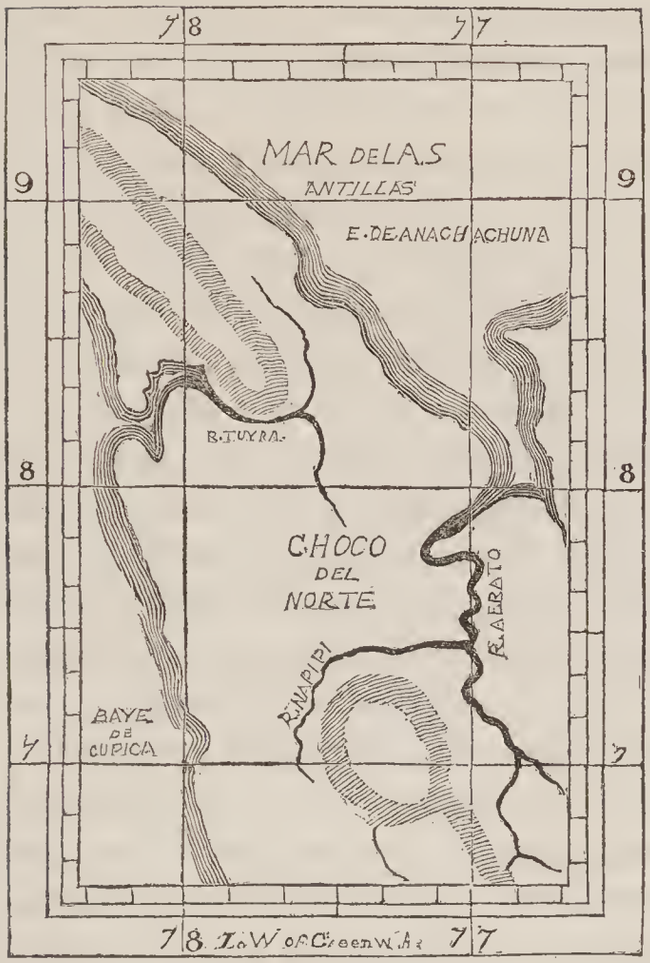
flows from the lofty Andes of Antioquia, and falls into the Atrato at some distance* above its mouth.

Besides these rivers, there are several others flowing from the west, of which no notice is taken in the map given in Humboldt's personal narrative; but many of which may be presumed to be of as much importance as the Napipi, and capable like it of being made, in conjunction with other rivers falling into the Pacific, the channels of commercial intercourse from the Atlantic to the Pacific. Among the rivers capable of being rendered subservient to this object, the author of the article already quoted from the Quibdo Journal, speaks of the Jurado which falls into the Pacific, and the Trucundo a tributary of the Atrato. But possessing no information whatever respecting these rivers, beyond the mere enunciation of their names and the basins into which they fall, it would be impossible to arrive at any conclusion, with respect to the advantages or disadvantages of substituting them for the Napipi and the bay of Cupicà.

From what has been observed respecting the basin of the Atrato, the almost incessant torrents which must descend into it from the wooded heights, which inclose it for about three-fourths of its course, the magnitude of the tributaries which on either side contribute to swell its flood, and the almost rectilineal direction of its bed for so considerable a portion of its course, we are almost at a loss to account for the small velocity of its current, as stated in the Reverberacion Mercantil; otherwise than upon the supposition of the inclination of its bed deviating but little from the horizontal, and the actual force of the current resulting rather from the vis à tergo than from the degree of the declivity: and this supposition is in the strictest accordance with the evidence given by Humboldt, who informs us that "in the Chocò del Norte the mountains lower to such a degree, that, between the Gulph of Cupicà and the Rio Naipi, they disappear altogether."†

* Latitude 7° 45′, longitude 77° 00′.

† "In order to form a precise idea of this absence of mountains at the Southern extremity of Panamà, we must bear in mind the general outline of the Cordilleras. The chain of the Andes is divided at the 2° and 5° of latitude into three chains, and the two longitudinal vallies that separate those chains, form the basins of the Magdalena, and the Rio Cauca. The Eastern branch of the Cordilleras inclines towards the N. E., and joins itself by the mountains of Pamplune and Grita, to the *Sierra Nevada de Merida*; and the chain of the coast of Venezuela, and the intermediate and western branches of Quindiu and Chocò, run into one another in the province of Antioquia, between the 5° and 7° of latitude, and form a groupe of mountains of considerable breadth, stretching by the *Valle del Osas*, and the *Alto del Viento*, towards Cazeres, and the elevated savannahs of Tolu. Further west, in the *Chocò del Norte*, the mountains lower to such a degree, that, between the Gulph of Cupicá and the Rio Naipi, they disappear altogether. It is the astronomical position of that isthmus, and the distance from the mouth of the Atrato to its confluence with the Rio Naipi (Napipi), that should be fixed with precision.—Pers. Narr. vol. vi. p. 251, &c.



In the absence, therefore, of every thing like correct observation, we may safely conclude that the difference between the highest level at the point where the bed of the Napipi approaches, to within the shortest distance of the bay of Cupicà, cannot greatly exceed one hundred feet; which, divided by $7\frac{1}{2}$, the distance or nearly the distance in British statute miles between this point and the Pacific, gives a slope of about 13 feet and a quarter per mile, or about two inches and a quarter in every hundred feet:—a slope so trifling as not to be distinguished by the eye from a perfectly horizontal level, and opposing no difficulty either to the formation of a rail-road, for the conveyance of goods with rapidity by means of locomotive engines, or a canal of large dimensions, capable of receiving vessels of such burthen as are adapted to the navigation of the Atrato and the Napipi.

To which of these modes of communication a preference should be given, depends upon circumstances with which we have not at present the means of becoming acquainted; all that we at present know is, that the bar or shallows at the entrance of the Atrato, and the want of depth as well as breadth in the stream of the Napipi during above two-thirds of its course, oppose considerable obstacles to navigation upon a large scale. How far these obstacles admit of being removed at a moderate expense, so as to admit the passage of vessels of from 500 to 1000 tons burthen, and drawing from 12 to 16 or 18 feet of water, remains to be determined by future surveys; to which also must be referred the determination of the astronomical positions of the several landing points, by careful observations.

Were it possible to effect this at a reasonable expense, a canal of large dimensions would undoubtedly be the most eligible mode of communication between the Napipi and the Pacific; since by this means vessels from Europe would be able to proceed to the distant shores of India, the islands of the Pacific—many of which are already rising iuto commercial importance—or the western shores of the New Continent, without the delay, trouble, and expense, of shifting their cargoes. This was the object which Patterson had in view, in his memorable but unhappily abortive Darien scheme, in the year 1669, which has been already incidentally noticed.

This enterprizing patriot, whose exertions deserved a better fate and a brighter reward, was well aware that a passage from one point to another with a single wind, was attended with less danger and required fewer hands, than a passage through many latitudes, in many directions, and requiring in consequence a variety of winds:—a fact established by the existence of vessels in the South Seas, of from seven to eight hundred tons burthen, navigated by not more than from eight to ten men, whose labour consists in little more than making sail at the commencement, and taking it in at the termination of the voyage. The same trade wind which carried ships from England to the mouth of the Atrato, would, if the navigation were open, convey them by that river, the Napipi, and the canal, at once into the bosom of the Pacific; and across its waters, without shifting a sail or slackening a brace, to the island of Bombay, or the mouth of the Hoogley: while on their return from thence, by pursuing a northerly course as high as the 40th degree of latitude, and taking advantage of the westerly winds, which usually prevail there with a regularity little inferior to that of the trades, they could reach the coasts of Mexico with little difficulty or danger, following the ordinary track of the Arcapulco ships; and here the land wind, which invariably blows in the direction of from north to south, would reconduct them along the coast to the bay of Cupicá; when, entering the canal, a steam boat might tow them to the entrance of the gulph of Darien, whence their voyage home would be the same as it is at present from other parts of the West Indies. Vessels bound to Nootka Sound, and other parts of the north-west coast of America, would only have to avail themselves of the trade wind, to such a distance from the coast as their circumstances required; after which, on their return, they would derive the same advantages from the polar current, as vessels returning in the manner pointed out from the East Indies.

Should, however, the result of an accurate survey of the Atrato and the Napipi, or any other river which may be selected, prove the impracticability of affording to commerce an unbroken navigation, at a cost which would reimburse the outlay and risk of the speculators, it may still be possible to obtain some of the advantages proposed by a navigation on a smaller scale, to the nearest practicable point of the Napipi, and continuing the communication from thence to the Pacific by a rail-road and locomotive engines. In this case, Carthagena would become the great commercial depot of the trade between Europe and tho East, and would soon vie with the ancient Alexandria in splendour, reputation, and commercial and political importance.

Here the ships from Europe, from the United States of America, from Brazil, and other parts of the eastern coast of the New World, would discharge the cargoes destined for the East, for the western shores of America, or for the multitudinous islands scattered over the Pacific, and take on board the return cargoes from those quarters which were awaiting their

arrival: the former cargoes would be conveyed, either by the usual coasting vessels of the country, or by steam boats adapted to the navigation of the rivers, to the commencement of the rail-road on the banks of the Napipi; and, after once more landing, be conveyed in less than an hour's time to the vessels waiting for their reception in the harbour of Cupicà, which the government of New Granada has already, with a commendable foresight, declared a free port, and thus the cargoes would be conveyed with little delay and almost as little risk to their respective destinations. New and populous towns would rapidly spring up in regions now desert, unfrequented, and indeed unknown; centres of civilization would be formed at Carthagena, on the banks of the Napipi, and on the shore of the Pacific. The eye of science would be enabled to penetrate into regions closed against discovery from the very instant of the creation; while the enterprize of commerce would pour into the lap of Europe treasures hitherto undreamt of, and productions to which she has hitherto been a stranger.

It does not fall within the province of a sketch like the present, to enter into calculations as to the probable cost of the improvements suggested, or the return which might be reasonably expected for the capital embarked in the speculation; the object of this paper is merely to shew the practicability of the scheme, and point out in the most general way the advantages which can hardly fail to accrue from its execution. The government of New Granada is not insensible to the benefit which the vast and fertile regions which compose the territory over which they preside, must derive from the projected communication between the two oceans; and a decree has already, as there is reason to believe, been passed, authorising the executive to receive proposals, and enter into arrangements with persons disposed to attempt it. As an inducement to embark in the undertaking, it has been proposed to grant the tolls upon all goods conveyed by this line to the company or individuals concerned, for a period of fifty years, together with a grant of a large extent of waste land, which the adventurers are to colonise and cultivate at their own expense, and for their own profit. To these might be added such other stipulations on both sides, as might tend to the more certain success of the project, and to the mutual advantage of all concerned.

The province of the Chocò, it should be remembered, is celebrated for its mineral as well as its vegetable riches; its mountains yield gold, silver, and platina; while its forests furnish timbers of requisite beauty for the cabinet maker; and, above all, for those wonderful fountains of nutritious milk, which a munificent Providence has taught to flow from the trunk of a tree, as a monument at once of his power and his goodness.

MORAL STATISTICS OF FRANCE.

[In our second number we gave a brief notice of M. Guerry's "*Essai sur la Statisque Morale de la France*," but a fuller analysis of this celebrated work having been subsequently communicated to the Literary and Philosophical Society by Mr. C. B. Fripp, we think our readers will have pleasure in reviewing this interesting subject more at large.—Ed.]

Before proceeding to the analysis of M. Guerry's work, which will form the main subject of this Essay, it may be useful to offer a few remarks on the nature and progress of *Statistics* in general. This science is in a great measure one of recent growth, and indeed the very term is so new to our language, as not to be found in the earlier editions of Johnson. The want of interest in researches of this kind, which is observable even in the present day, may be traced to various causes; one of which is no doubt the repugnance felt by many persons to details which can be adequately represented only by figures, the due examination and comparison of which involve no slight degree of application.* Beside this, in lifting the veil from the surface of society, and exposing its real condition to view, statistical science, in its *moral* department, acts the part of a faithful but unwelcome monitor; and reveals to us, in the most legible characters, a mass of disorder and crime, which, however chequered by brighter features, is almost certain to repel the fastidious taste of the sentimentally benevolent, if it does not dishearten and overwhelm the genuine philanthropist.

Of all the causes which contributed to the military greatness of the ancient Romans, their wonderful organization, founded on the results of their periodical census, is most conspicuous. The frequent enumerations of the people, from the time of Servius Tullius (about 570 B. C.), to the year 73 of the Christian era, and the particulars of their social condition then deposed to, appear to have been registered with much care in a tabular form; and had these records come down to us, more especially in a completed state to the time of Constantine, it would be a matter of great interest to compare them with the results of later inquiries. They could not fail to clear up many unexplained difficulties in contemporary history, and they would throw a new light on the causes of the decline and fall of that monstrous creation of military power, the Roman Empire; which, in the later period referred to, had acquired a distaste for the severe and healthful institutions of its early days, till at length (to use the words of a popular writer) the world beheld in it "but a bloated and feeble giant,

* Statistical inquiries have been humorously described as "the Cause,—the Figures of Arithmetic, *versus* the Figures of Speech."

whose brain is imbecile, whose limbs are dead, and who pays in disease and weakness, the penalty of transcending the natural proportions of health and vigour."

During the middle ages, we have to lament the almost entire neglect of statistical research. A dark cloud seemed to hang for many centuries over the human mind, and to hide from view the true sources of a country's greatness. Political aggrandisement by force of arms, and at the expense of every rival, rather than a common growth and prosperity by union and co-operation, as members of one great family, is, unhappily, what history records as the object of almost universal ambition. It is not to be wondered at, that in such times neither the governors nor the governed were alive to the importance, or favourably disposed to the exhibition of those facts, which illustrate the social advancement of a people, and which teach them that prosperity follows rather in the silent track of peaceful industry, than in the dazzling march of the military conqueror.*

In later times our own country has the credit of having led the way in the science of Political Arithmetic. About the middle of the seventeenth century, a valuable work was published by Capt. John Graunt, "On the London Bills of Mortality," in which considerable progress was made in the classification of deaths from different diseases; and many interesting facts collected relative to the ravages of the plague, which at various periods desolated the metropolis. Subsequently, a good deal of information on different branches of Statistics, was furnished by Sir Wm. Petty, Dr. Halley, and Dr. Davenant; but, with the exception of inquiries as to the amount of the population and the laws of mortality, (a knowledge of which was essential in the calculation of *annuities)* little was done in the last century to give consistency and arrangement to the mass of statistical facts that were accumulating on every side, from the labours of independent inquirers.†

* Is not this the lesson which all history impresses as the most essential to social progress, or what Mackintosh finely calls "the education of the human race,—that vast work of so many ages, of which we see only a few steps?"

† We must not, however, pass without notice two important works, published about the close of the last century, Sir John Sinclair's "*Statistical Account of Scottand,*" in 21 vols. 8vo. and Colquhoun's "*Treatise on the Police of the Metropolis.*" The former work, though far too diffuse and susceptible of great improvement (which it is in fact receiving in a second edition, now in course of publication), deserves the reputation of being the most exact and comprehensive of its kind that British science could then exhibit; and Mr. Colquhoun's volume—the first English work on the *Statistics of crime*—besides its value as an exposition of facts relative to the morals of the metropolis, is distinguished by its anticipation of most of those improvements recently effected in criminal jurisprudence, and by an enlightened spirit of practical benevolence, equally honourable to him as a man and a magistrate.

It may be interesting to some to know that a statue of Sir John Sinclair is about to be erected in the town of Thurso, in memory of the benefits which his patriotic labours have conferred on Scotland.

A new impulse has recently been given to statistical research. At the meeting of the British Association at Cambridge in 1833, a *statistical section* was engrafted upon the Association, principally through the zealous exertions of a distinguished foreigner, M. Quételet of Brussels. Subsequently and through the efforts of this section, a General Statistical Society has been formed in London, which has the Marquis of Lansdown for its President, and enrols among its members many of our public men, the most distinguished for enlightened patriotism and scientific attainments. It is the aim of this Society to encourage the formation of branches in every part of the kingdom. In Manchester a Statistical Society was still earlier formed, and the communications which have been made by its members, particularly by Mr. W. R. Greg, to the British Association, are evidence of the zeal and talent with which its proceedings are conducted.*

The object of the *Statistical Society* is simple, but comprehensive. Its motto might be the admirable and well-known aphorism of Lord Bacon, which M. Guerry prefixes to his work: "Homo, naturæ minister et interpres, de naturæ ordine tantum scit et potest quantum *observaverit*, nec ampliùs scit aut potest."—(Nov. Org.)

Statistical science does not intrude on the province of moral and political philosophy. It deals not with the powers and affections of our nature, as to their essential character and relations, but only investigates the numerical laws developed in their external effects and operations; thus giving, as Professor Sedgwick says, "the *raw material* to political economy and political philosophy," and helping to lay a firm *foundation* for those sciences. The Society announces that its aim is "to procure, arrange, and publish facts, calculated to *illustrate the condition and prospects of society*." Its first and most essential rule is to exclude what is merely *opinion*, to confine its attention rigorously to facts, and as far as possible to such facts as can be stated numerically, and arranged in tables. In the collection and arrangement of these facts, and in reducing the laws which they display to "the order, the harmony, and the consistency of theory," great patience and labour are required; the field of investigation is almost boundless; and it is only from very numerous and diversified observations that general results can safely be deduced.

Rich as is the history of the human mind in the department of rash speculation, it would be difficult perhaps to find instances of greater absurdity, and more marked contempt of experience and scientific research, than the records of *legislation* display. The most intricate and momentous questions, affecting the well-being of millions, have been settled at all hazards, according to the prejudices of the day, with little or no regard to

* It is gratifying to find that an office has recently been opened at the Board of Trade, for the collection and publication of official documents connected with statistical subjects.

the evidence of facts, or to those fundamental laws of human action, which must eventually control and modify all conventional rules.* We must ascribe this in certain cases to the necessity of fixing *some* laws—be they good or bad—before the condition of a people can become the subject of statistical investigation; but the grand source of this anomaly, in all ages and countries, has been the struggle of private interests, or the conflict of political passions, when the welfare of the whole community should be recognised as the only proper rule and standard. "In moral and political reasoning," it has been well said, "we have ever to do with questions in which the waywardness of man's will, and the turbulence of man's passions, are among the strongest elements." It is of the greatest consequence then when such weighty interests are at stake, to give moral and political philosophy the sound basis of *facts*, and to assimilate their processes, as far as possible, to those of demonstrative science. We all recollect the famous saying of Hobbes, "that if it had been a thing *contrary to the* [supposed] *interests of men* that the three angles of a triangle should be equal to two right angles, that doctrine would have been, if not disputed, yet suppressed, as far as they whom it concerned were able."

But all arguments against *experience* are fallacious; and in physical truth (to quote again Professor Sedgwick's words), "Whatever may be our difference of opinion, there is an ultimate appeal to experiment and observation, against which passion and prejudice have not a single plea to urge." Why then should not our moral and political reasoning, so far as practicable, be made subject to the same criterion? Complex and diversified as are the motives that influence the human will and

> "Human action,
> That is the seed too of contingencies
> Strew'd on the dark land of futurity,"

their general results in the character and condition of society may legitimately be classed within the province of inductive science. These results are susceptible in a great degree of being reduced to measurement and

* "No advantage in moral policy can be lasting, which is not founded on the indelible sentiments of the heart of man. Whatever law deviates from that principle will always meet with a resistance, which will destroy it in the end."—Beccaria on Crimes and Punishments (quoted by Simpson, "On Popular Education," p. 280).

The same principle is strongly urged by Dr. Hampden in his "Lectures on Moral Philosophy;" an almost invaluable book to the student of human nature, and full of the elements of thought. "Ignorance of the nature of man, and of his condition in this world, will be found at the bottom of those wild theories of the regeneration of society and revolutions of government, which speculatists or the seditious have devised."...."How much vain disturbance, how much severe suffering, might have been saved, had a diffused knowledge of the principles of human nature established a general conviction, that there were impossibilities in the moral no less than in the physical world!"—pp. 55, 61.

calculation; and unquestionably will be found to develope general laws, no less remarkable and worthy of investigation than those which obtain in the physical universe.

It is incredible how much the world has lost, from the neglect of those inquiries which it is the object of the Statistical Society to promote. How much pernicious legislation might have been checked,—how many ruinous and sanguinary wars avoided,—how much crime prevented, and happiness diffused, had it been the constant care of each community to collect and give publicity to those facts, which demonstrate the real causes of a nation's prosperity, and exhibit the practical results of its institutions! The extent, productions, and resources, of a country,—the population, mortality, and rate of increase, the occupation of the different classes, and the distribution of wealth among them,—the state of the currency and taxation, the progress of agriculture, commerce, and manufactures,—the condition of the poor,—the state of education, religious instruction, and of crime,—are all matters that come within the province of statistical inquiry; and could a people be well disciplined in a knowledge of their actual condition in these various respects, it could not fail, under the blessing of Providence, to introduce more harmony into their social conduct, to establish the true civil policy of the country, and in every way to advance its prosperity.*

We might give many and striking instances of the disgraceful neglect of statistical research in England, and of the errors and inconsistencies, both of legislation and practical statesmanship, which have resulted from this neglect. We can here, however, only refer to the remarks of other writers on the same subject, which will be found too amply justified by facts.†

Statistics have been conveniently divided into *four* general classes,—*economical*, *political*, *medical*, and *moral*. The three former of these divisions embrace the facts relating to the productions and wealth of a country, its political and civil institutions, the laws of population, mortality, &c.; and to these elements statistical inquiries (scanty as they are at best) have been hitherto restricted. The subject of *moral* Statistics is emphatically

* "When we look beyond the range of physical tangibilities, into the region of mental and moral relations, in short the science of man, upon which depend the wisdom of our legislation, and the soundness of our institutions and customs, what a scene of uncertainty do we see! Fixed principles in social affairs have not yet been attained. . . . . If any measure affecting the public is propounded, there arises a perfect hurricane of opposition and denunciation, as if it were the most monstrous of errors, and the most atrocious of crimes. No plan or project, religious, civil, economic, or merely ornamental, can be proposed without tearing to pieces the conventions of courtesy — nay, the feelings of common charity, and exposing a lamentable scene of inconsistency and passion."—Simpson on Pop. Educ. p. 40.

† Edinb. Rev. xlix. 413, lxi. 158. For. Quart. Rev. xvi. 211, &c.

man,* in some of his most interesting social relations, and especially as an agent responsible to his fellows. The first step in the formation of political society is the institution of certain laws, and the transference of power and authority to some one or more of the community, to enforce their observance under suitable penalties. The great end of all civil institutions is the due protection of person and property, in other words the establishment of the *rights* of all. Mr. Hume informs us,† that "we are to look upon all the vast apparatus of our government as having ultimately no other object or purpose but the distribution of *justice*, or in other words, the support of the twelve judges: kings and parliaments, fleets and armies, officers of the court and revenue, ambassadors, ministers and privy councillors, are all subordinate in the end to this part of the administration."

Without an intimate acquaintance, however, with the facts coming under the head of the Statistics of Crime, penal legislation must be a course of blind and hazardous experiment. We shall not know either the amount of moral evil with which society has to contend, or where existing checks and preventives require to be strengthened. No government, therefore, can stand excused, which neglects the establishment of the data that are required to give a proper direction to criminal jurisprudence, and to advance safely in the work of national improvement.

M. Guerry's work relates wholly to the department of *moral* Statistics; and we are indebted to him as being the first to exhibit, in a systematic form, the principal facts illustrating the social condition of one of the great European Powers. France offers particular advantages for investigations of this nature. Since the year 1792, when the custody of the registers was transferred from the ecclesiastical to the civil authorities, they have been kept with great care and exactness in respect to those facts which develope the laws of population and mortality: but the earliest published documents relating to the administration of criminal justice that can be relied on, do not date earlier than 1825. It is now the custom in France for the Procureurs Généraux (officers nearly corresponding to the Procurators Fiscal of the Scotch courts) to transmit, every three months, to the Keeper of the Seals an accurate register of the business of the local judicial courts. These returns are classified on a systematic plan, and, after careful examination, an analysis is made of them at the end of each year, and published under the title of "Compte général de l'administration de la justice criminelle." The very rigid system of police established in France, and the superior intelligence of the functionaries to whose custody criminals are committed, combined with the centralising controul exercised

* "That comprehensive atom!—all the world
In act of thought embracing; in the world
A grain, scarce filling a particular space!"

Phil. Van Artev. ii. 221.

† Essays, i. 32.

by the higher branches of government, (however objectionable on some grounds) have undoubtedly the effect of enabling that government to collect the Statistics of Crime, in a far more complete and scientific form than is practicable under the existing arrangements in this country. And it is, I believe, with truth that M. Guerry remarks, "Never among any people has an undertaking of the kind been executed in a manner so complete:" and, though as yet little known in France itself, this digest of facts has rightly obtained from foreigners the appellation of a national monument, and has been viewed as a model for the imitation of all civilised nations, who have any desire to be acquainted with their moral condition. Many of the European states indeed are now following the example of France, but few of them have as yet adopted a system so comprehensive and exact.

Favoured perhaps by his situation as an advocate in the royal court, M. Guerry has availed himself of all the official documents bearing upon his subject, and has combined and classified them under all the various aspects they can be made to assume. His essay was published in 1833, having been first submitted to the French Institute, by whom as usual it was referred to a committee consisting of M. M. Lacroix, Silvestre, and Girard. The reporter of the committee (M. Girard) bears strong testimony to the fidelity with which our author has treated his subject, and especially to his entire freedom from bias to particular systems—a matter of no slight moment in a compiler of statistical tables. His conduct on this point indeed is worthy of all praise and imitation.*

The official returns, which form the ground-work of M. G.'s volume, relate to *crimes*, as modified by sex, age, and season, their apparent causes, their relative frequency, and geographical distribution; the state of *instruction* throughout France, of charitable *benefactions*, and the number and distribution of *suicides*, besides a mass of other particulars which M. G. ha condensed in an appendix.

We must notice that the estimates of the number and proportions of crimes are not founded on the number of the *convicted*, but on that of the *accused*, it being of no consequence as to the statistical result, whether the accused in each case is the guilty party or not, so long as the crime itself is established as a fact. From the formalities necessary before a case can come before a jury in France, (which are even greater than among ourselves) M. G. estimates that out of 1000 cases brought before the courts of Assize, there are scarcely 20 in which the acquittal of the

* "Aucun esprit de système ne nous a dirigé, nous n'avons cherché d'appui à aucune théorie. C'eût été montrer des vues peu philosophiques, et mal comprendre les intérêts de son pays, que de s'attacher à faire ressortir les faits favorables à une doctrine en négligeant ceux que lui paraissaient contraires. Nous avons d'ailleurs fait connaitre avec soin les sources où nous avons puisé, et donné ainsi les moyens de s'assurer de notre exactitude et de notre sincérité."—Pref. p. iii.

accused has arisen from defective proof of the actual commission of the crime. On the other hand, were the state of crime estimated only from the number of persons *convicted,* the errors would probably be serious.*

It would be a task of great interest to compare together the criminal Statistics of different states, but as yet there are insuperable difficulties in the way. As a preliminary requisite, we must establish a common standard of legislative morality, and an uniform activity in the executive police. From differences in these respects, the statistical records of one country may shew a much smaller amount of crime than those of another, where perhaps no real superiority exists: and without bearing these considerations in mind, we should fall into great errors in comparing different epochs in the history of a nation, or the morality of different countries at the same period.

It appears that on the average, 72 out of 100 accused are connected either by birth or residence with the department in which they are brought to trial. This proportion increases to 84 in 100, in respect to crimes against the *person,* and falls to 69 in 100 as to offences against *property.* Not above 3 in 100, of the accused throughout France, are found to be foreigners.

To give value and certainty to Criminal Statistics, it is necessary to arrange and combine facts, so as to divest them of whatever is merely accidental. Adopting this principle, M. G. assures us that general results can be established, so uniform and constant as to preclude the supposition of their mere fortuitous recurrence.† In proof of this position, M. G. in the first place institutes a comparison between the number of crimes committed within a given period, in different parts of the kingdom. For sta-

* The criminal records of our own country confirm the opinion, that the number of *convictions* only affords very inadequate data from which to estimate the amount of crime. It is constantly found that the proportion of *convictions* to *committals* is greatest in the case of offences, of which the punishment is least severe. Thus in 1832, out of 107 persons committed for arson, only 35 were convicted; and for murder, out of 66 committed, only 20 were convicted; while for larceny, 10,130 convictions were obtained out of 13,469 committals. In Scotland the whole number of acquittals and liberations bears a considerably higher ratio to the committals than in England; and this arises from the very large number who in Scotland are liberated without ever being brought to trial, being very nearly 1-3 of the whole committals, instead of about 1-7, as in England. It is understood, however, that by far the greater number of these persons are so liberated, not because they are believed to be innocent, or even because there would be any difficulty in proving their guilt, but under the feeling that they are sufficiently punished by their incarceration previous to the time of trial. (Vide British Almanack and Companion for 1834, p. 66.)

† "Chaque année voit se reproduire le même nombre de crimes dans le même ordre, dans les mêmes regions; chaque classe de crimes a sa distribution particuliére et invariable, par sexe, par âge, par saison: tous sont accompagnés, dans des proportions pareilles, de faits accessoires, indifférens en apparence, et dont rien encore n'explique le retour."—p. 9.

tistical purposes, he divides France into five regions, each consisting of seventeen adjoining departments, not arbitrarily grouped together, but according to their geographical position, and which he distinguishes as the *north, south, east, west,* and *centre.**

This geometrical arrangement of the departments is very advantageous for the comparison of facts, which must be studied in masses, and it is adhered to by M. Guerry, as a basis throughout his work. Another general distinction to be kept in mind is, the division of crimes into two classes, according as they are directed against the *person,* or against *property.*

If now we represent the whole number of crimes committed in one year in France by 100, their distribution among the five regions is shown by the following table.

No. 1. A. *Crimes against the Person.*

Years	1825	1826	1827	1828	1829	1830	Mean
North	25	24	23	26	25	24	25
South	28	26	22	23	25	23	24
East	17	21	19	20	19	19	19
West	18	16	21	17	17	16	18
Centre	12	13	15	14	14	18	14
	100	100	100	100	100	100	100

B. *Crimes against Property.*

North	41	42	42	43	44	44	42
South	12	11	11	12	12	11	12
East	18	16	17	16	14	15	16
West	17	19	19	17	17	17	18
Centre	12	12	11	12	13	13	12
	100	100	100	100	100	100	100

From this table it appears that the relative proportion of crimes committed in either of the five regions does not vary on the average of six years (1825-30), more than 1-25 part for crimes against the person, and not more than 1-50 part for crimes against property. Thus, strange as it may appear, it is certain, says M. Guerry, "que le produit annuel des récoltes

* The population of these five regions (1830) is stated as follows :—

North	8,757,700
South	4,826,493
East	5,840,996
West	7,008,788
Centre	5,238,905
	31,672,882
Corsica	185,079
Total	31,857,961

ou des impôts, dans les diverses parties du royaume, ne saurait être évalué d'avance avec plus de précision, de certitude que le nombre des vols, des meurtres, et des assassinats."

Sex.—Of every 100 persons charged annually with *theft* throughout France, the proportions of delinquents according to *sex*, are as follow.

No. 2. A. *Sex of those accused of Theft.*

Years	1826	1827	1828	1829	1830	Mean
Men	79	79	78	77	78	78
Women	21	21	22	23	22	22
	100	100	100	100	100	100

Thus the proportion of thefts committed by criminals of *different sexes* is constant within 2-100.

Age.—Of every 100 Persons accused of theft, the criminals classified by their *age* stand thus :

B. *Age of those accused of Theft.*

Of 100 criminals	1826	1827	1828	1829	1830	Mean
Age from 16 to 25 years	37	35	38	37	37	37
25 to 35 years	31	32	30	31	32	31
35 and upwards	32	33	32	32	31	32
	100	100	100	100	100	100

Here the greatest difference between any one year taken separately, and the average of five years, does not exceed 2-100, and is for the most part only 1-100.

Seasons.—The influence of the seasons in relation to some particular crimes, is shown to be equally constant and regular, the difference in any one season not exceeding by more than 2-100 the mean of four corresponding seasons.

When we reflect on the infinite variety of circumstances which may influence the production of crime, and the external or purely personal causes that may determine its character, it is not easy to conceive how things should concur to bring about such uniform results; and that voluntary actions, when viewed in masses, should be developed in a fixed order and be included within such precise limits. The fact illustrates the distinction which an ingenious writer has alluded to (but in another sense) between *man* and what we term *mankind*. The individual, as the subject of moral responsibility, is a free agent, and his life is a constant series of phenomena, more or less voluntary; but when a number of these series are compared together, the *terms*, if we may so speak, correspond or differ in such regular order, that what was most uncertain in the individual becomes

a law in the aggregate; and where all seems at first sight caprice and accident, we find fixed boundaries and uniform results.*

The following table exhibits a classification of the crimes annually committed in France (with the exception of those that come before military and naval tribunals) in the order of their relative frequency, and as committed by offenders of different sexes. On the average of six years (1825-30) the total number of crimes amounts to 7147 annually, of which, crimes against the person constitute 1865, or about 1-4 part; offences against property the remaining 3-4, or 5282.

No. 3. Crimes in the order of Frequency, &c.

(Average of six years, 1825—1830.)

A. *Crimes against the Person.*

Nature of the Crime.	Annual No. of Crimes.	Proportn in 1000.	Proportion in 100 committed by Men.	Women.
Murder and manslaughter	553	297	92	8
Cutting and wounding	453	243	88	12
Assaults on women and children	306	164	99	1
Crimes against the state	237	127	91	9
Infanticide	118	63	6	94
Perjury and subornation of perjury	87	47	85	15
Poisoning	40	21	55	45
Parricide	13	7	64	36
Bigamy	11	5	98	2
Other crimes against the person	47	26	56 Mean	44
Annual total..	1865	1000	86	14

B. *Crimes against Property.*

Nature of the Crime.	Annual No. of Crimes.	Proportn in 1000.	Proportion in 100 committed by Men.	Women.
Robbery of various kinds (not otherwise specified)	3219	610	83	17
by domestics 4475	1043	198	60	40
on the highways	159	30	92	8
in churches	54	10	78	22
Frauds and forgery of various kinds and coining	478	91	92	8
Fraudulent bankruptcy	105	20	86	14
Incendiarism and destruction of property..	129	24	84	16
Other crimes against property	95	17	82 Mean	18
Annual total .	5282	1000	79	21

* The reflection which Schiller puts into the mouth of Wallenstein, when denying

Of the crimes against the person, it appears that 1-4 consists of assaults and bodily injuries; 1-3 of deaths by violence, (and which, coupled with suicides, amount to not less than 700 annually, or nearly 2 *per diem;)* and infanticide, perjury, poisoning, &c. fill up the list in successively decreasing proportions.

Of crimes against property, 85 in 100 consist of *thefts* of various kinds. Robberies by domestics form 1-4 of the total number of robberies: highway robbery does not amount to 1-30 of the whole. After theft come the various kinds of fraud, incendiarism, forgery, &c.

The total number of offences against property (though not the more serious kinds, nor crimes of violence) seems to have increased of late years both in France and England; but this M. G. mainly attributes to the number of relapsed criminals *(les récidives)* among the young, and to the neglect of prison discipline. There is a Gaelic saying, "It is not easy to straighten in the oak the crook that grew in the sapling;" and no proof is wanting from criminal records to convince us, that any great and decided improvement in national morals must be produced by operating on the minds and manners of the young. Unfortunately this class, when delinquents, are treated nearly as if they were grown up and hardened offenders; and from being intermingled with associates who have known more of vice than themselves, they seldom come out of prison half so corrigible as they went in. M. Guerry's reflections on this topic are very judicious and interesting, but we have not space here to exhibit them in detail.

Crimes of both classes are (as might be supposed) committed in very different proportions by offenders of different sexes. As a general result it appears that

Of every 100 crimes against the *person,* 86 are committed by men;
.. .. 14 .. women;
.. .. *property,* 79 .. men;
.. .. 21 .. women.

We must be cautious however in taking these numbers as indicative of the comparative *morality* of the sexes, on account of the great difference existing between them as to their temptations and physical ability to commit crimes: so that M. G. is led to conclude, that although on the whole we may allow a higher morality to the sex, there is in reality less disproportion in this respect than is commonly supposed.

Of crimes against the person committed by women, poisoning forms

that his destiny is in the hands of chance, may be applied as well to the community as to the individual man:

"Know that the human being's thoughts and deeds
Are not, like ocean-billows, blindly moved:
The inner world—his microcosmus—is
The deep shaft out of which they spring eternally:
They grow by certain laws, like the tree's fruit;
No juggling chance can metamorphose them."

6-100; of those committed by men, it is only 1-100 part. Infanticide constitutes 2-5 of the crimes against the person committed by women; and no crime demonstrates more vividly than this the sad perversion of the natural affections, and the intensity of emotion to which women are frequently subject.*

M. Guerry's tables illustrating the influence of *age* on the commission of crime, are very elaborate and minute; but we can only find room for the following table, which represents the proportions in which crimes (combining together those against person and property) are committed at different periods of life by the two sexes. We should observe, however, that without knowing the comparative number of persons of each sex and age living at the same time in France, (an element of the calculation which M. G. does not give us) we cannot take these numbers as accurately indicating the law of tendency towards criminal actions at different periods of life.

No. 4. *Proportion of Crime at different Ages.*

AGE OF THE CRIMINALS.	Of 1000 Crimes committed by	
	Men.	Women.
Below 16 years	19	14
From 16 to 21	169	135
21 to 25	162	158
25 to 30	182	185
30 to 35	144	148
35 to 40	91	117
40 to 45	76	84
45 to 50	59	66
50 to 70	98	93
	1000	1000

M. G. states that his general conclusions on this head agree perfectly with the results published by M. Quételet in his recent Essay, "*Recherches sur le penchant au Crime aux différens âges,*" and which may be thus

* Strange as it appears, M. G. notices it as an unquestionable fact, that maternal tenderness and apprehensions of their children's future troubles, sometimes lead women to commit this most unnatural crime. At the same time, nothing in their previous conduct may create the suspicion of insanity: the crime is regarded as an act of devotedness—is long dwelt upon—and at length is committed without compunction. In most cases however the unhappy mother immediately after completes the tragedy by self-destruction; leaving it scarcely doubtful that the evil propensity was the result of mental hallucination, though at the same time yielding testimony to the poet's aphorism:

"Every crime
Has, in the moment of its perpetration,
Its own avenging angel—*dark misgiving,*
An ominous sinking at the inmost heart!"

summed up. The maximum of crimes takes place in the period of life between the ages of 25 and 30. In this short term of five years, occur nearly 1-5 of the total number of crimes committed by either sex. Criminal tendencies are developed earlier in man than woman: with the first they gather comparatively greater strength between the ages of 16 and 21, and on the other hand, decline more rapidly than with women, particularly after the age of 35; but beyond the age of 50, culpable tendencies are nearly the same in both.

The influence of the *seasons* is shown in the different proportion of crimes committed in the several months and quarters of the year. We omit the table, the general result being that the greatest number of offences against the *person* are committed in summer, the smallest number in winter, spring and autumn being nearly alike;* and that with respect to crimes against *property*, these proportions are reversed, so that the maximum of one class coincides with the minimum of the other;—a fact certainly worthy of observation, as illustrating the system of compensation that prevails throughout nature. The different length of the days, rather than the variation of temperature, is considered by M. G. as the chief cause of the influence attributable to the seasons.

After some remarks on the importance of studying the Statistics of Insanity, with the view of determining if there is any connection between the greater prevalence of mental derangement, and of violent crimes at the same period of the year; M. G. proceeds to an estimate of the force of different passions and irregular habits in the production of the more serious crimes. His conclusions on this subject (which are only very partially shown by the table at foot†) are strongly confirmatory of the position which in this part of his work M. G. is led to dwell upon, viz. the coin-

* The crime of *infanticide* is more frequent in the spring and winter than in the other seasons, corresponding to the proportion of births in each period. The month of March, in which this crime is most frequent, is next to February, the month in which the greatest number of births takes place throughout the year.

† No. 5. *Apparent Motives of the Crimes of Homicide, Poisoning, and Incendiarism.*

		In 1000 crimes
I.	Hatred and revenge	264
II.	Domestic dissension	143
III.	Quarrels at play and in public places	113
IV.	To aid in or conceal theft	102
V.	Sudden broils	94
VI.	Local disputes and adverse interests	80
VII.	Adultery	64
VIII.	Debauchery	53
IX.	To secure the succession to property	26
X.	To obtain insurance premiums	25
XI.	Disappointed love and refusals of marriage	20
XII.	Jealousy	16
		1000

cidence of sound views of *utility* and *duty* as guides to our social conduct: but without going into the detail of facts which he has collected, exhibiting the evils of profligacy in its different shapes, (a task both painful in itself and here not suitable) it would be difficult to convey a sufficiently strong impression of the support which his researches furnish to the vital truth, that the rules of right and of utility are inseparable. The reporter justly characterises M. G.'s reflections on this subject as "*pleines de sagesse et de raison.*"

We come next to consider the *geographical distribution* of Crimes in France, by which we obtain a general idea of the comparative morality of different districts of the country, and are led to inquire into the causes of the diversities observed. The following table shows with reference both to crimes against the person and against property, the proportion of crimes to the population in each of the five regions, upon the average of six years, from 1825 to 1830 inclusive.

No. 6. *Crime and Instruction.*

REGIONS.	Accused of crimes against Persons.	Property.	Proportion of Scholars of male sex in 1829.	
South	1 in 11,003	1 in 7,945	1 in 43	Inhabitants.
East	.. 17,349	.. 6,949	.. 14	
North	.. 19,964	.. 3,924	.. 16	
Centre	.. 20,984	.. 8,285	.. 48	
West	. 22,168	.. 7,534	.. 45	
Mean of all France..	1 in 17,085	1 in 6,031	1 in 38	

From this table it appears that great disparity exists between different parts of the country, so far as their morality can be estimated by the proportion of crimes in each. Of the five regions, the *south* is that in which the greatest number of crimes against the *person* are committed relatively to the population. Next comes the *east*, then the *north*, *centre*, and *west*. In the two latter regions, these crimes are scarcely half so frequent in proportion to the population, as in the south. On comparing the departments individually, the difference is still greater; those of *Corsica* and *Creuse* being at the two extremes of the scale. In the first, there is one charge of crime against the person to every 2199 inhabitants; in the latter (Creuse), only one in 37,014, or in a ratio fifteen times more favourable than in Corsica. The mean for the whole of France is one accused to 17,085 of the population. Thirty-one departments present an average more favourable than this; the remaining 55 in different degrees exceed it. M. G. states in a table the numerical proportion for each department.

The relative position of the five regions, and of most of the departments

individually, is different with respect to crimes against *property*, as will be seen by the table. This class of crimes is most numerous relatively to the population in the *north*, next in the *east*, and the *west*, *south*, *centre*, follow in this order. In the latter region, these crimes are not half so frequent as in the north, in proportion to the population.

Among the *departments*, that of the Seine, in which the capital is situated, ranks first, as might be expected, in the scale of crimes against *property*; there being one accused to 1368 inhabitants. In *Creuse*, which exhibits an equally favourable morality in regard to this as to the other class of crimes, there is only one accused to 20,235 inhabitants. The mean for the whole kingdom is one to 6031: 62 departments present more favourable proportions than the mean, 24 are above it.

The distribution of the two classes of crimes is in general such, that by a happy compensation, those parts of the kingdom which shew the greatest number of crimes against the person are least fruitful in offences against property. There is an exception, however, in prejudice of the departments of Corsica, Seine-et-Oise, Mozelle, and Lozère, which stand unfortunately high in both scales.

M. G. enters at some length into the consideration of the causes which most materially influence the varied prevalence of crimes of each class. He sees reason to attribute the marked distinction in the distribution of crimes against the *person*, chiefly to differences of generic character among the tribes that constitute the population of France; all of whom still retain to a certain extent their own languages, customs, and traditional prejudices. The inhabitants of the south, where these crimes most abound, differ considerably in race and organisation from the inhabitants of other parts of France. The livelier sensibility and hastiness of temper which characterize them, give rise to numerous disputes and broils; and the passions of jealousy and revenge are not unfrequently evidenced in personal outrages among them.

With respect to the distribution of crimes against *property*, their apparent connection with the advancement of commerce and industry affords ground for very instructive inquiry. The question of the influence of wealth and poverty on national morals is one of the most intricate that Statistics can be brought to elucidate: but as yet we are in want of documents sufficiently authentic to deserve much attention. It must not be forgotten, in considering the influence of other causes on the amount of crime, that the absolute amount of wealth in a district is far from being an accurate index to the condition of the great bulk of the population. The recent researches indeed of M. de Villeneuve Bargemont fully confirm M. G.'s supposition, that the panperised districts in France, as in other countries, are precisely those in which at the same time wealth is most abundant.* Hence, the destitution and misery prevailing in a district where

* In the northern region, the chief seat of the cotton manufactories of France,

riches and civilization are rapidly increasing, may, for a time at least, completely check and nullify all the ameliorating influences that are simultaneously in operation.

M. G. exhibits a coloured chart and tables, illustrating the distribution of illegitimate births throughout France, as calculated by M. Villermé: but into the details we shall not here enter. The facts, however, which he has collected, lead him to express a decided opinion on the evils of such institutions as foundling hospitals, which sacrifice at the shrine of charity some of the strongest safeguards of the severer virtues: a case to which the reporter of the committee finds a parallel in the operation of the English Poor Laws, as he remarks, "C'est ainsi qu'en Angleterre la charité légale accroît indéfiniment le nombre des pauvres."*

Public Charities.

The degree in which the benevolent dispositions are manifested among any people, in the shape of public charities, constitutes an interesting feature in their moral character and condition: but the documents on this subject are too generally defective to afford any satisfactory conclusions. France however presents the best field for such inquiries, in consequence of the legal regulations under which all appropriations to religious or benevolent establishments must be made. For every such appropriation exceeding the sum of 300 francs (£12), a "royal ordinance of authorisation" is necessary: these ordinances are registered and inserted in the "Bulletin des Loix."

pauperism is as prevalent as in the worst regulated parts of England; every sixth inhabitant being dependent wholly or in part on charitable funds. In Creuse, a central department, and which exhibits the smallest proportion of crimes against person and property, but which presents such an aspect of poverty as to have been termed the Connaught of France, only 1-58 of the people are classed as paupers. These facts (says an intelligent journalist) "prove that, though the proportion is not every where exactly preserved, yet pauperism seems generally to increase with wealth and civilization:" and it is important to bear this tendency in mind, in considering the influence of instruction on the state of crime.—Economie Politique Chrétienne, &c. par M. le Vicomte A. de Villeneuve Bargemont: Paris, 1834.

* In the face of this obvious truth, what an outcry—disgraceful to the manly reason of the age—has been raised against that excellent measure, the Poor Laws Amendment Act! Its results however will soon convince the most inveterate gainsayers, that the system of indiscriminate relief is not that which best consults either the comfort or the morality of the poor. In a letter dated March, 1830, Mr. Coleridge has left on record a valuable testimony to this effect, which may fairly be opposed to the dolorous vaticinations of his later days, when declaiming against the new Poor Law arrangements: "It would be most unchristian moroseness not to feel delight in the unwearied zeal with which every mode and direction of charity is supported; and I hope that this is a sun-shiny spot in our national character.... *But it would on the other hand be wilful blindness not to see that the lower orders become more and more improvident in consequence, and more and more exchange the sentiments of Englishmen for the feelings of Lazzaroni.*"—Letters, &c. i. 27.

M. G. exhibits the results of his investigation under the three heads of

1. Gifts and bequests to the poor;
2. .. to the clergy and religious establishments;
3. .. to schools.

His calculations are founded solely on the number of such donations, without regard to their value, for reasons which he satisfactorily explains.

1. Of the total number of gifts and bequests, more than half, or 52 in 100, are made in favour of the poor, hospitals, &c.; and of these about 3-5 by men, 2-5 by women. Anonymous donors to the poor are in the proportion of 1 to 16. Of donors to the clergy, only 1 in 49 conceals his name. About double the amount is bequeathed to the poor, of that which is legally transferred for their use, *the donors still living*; and a curious diversity occurs in the proportions in which charity is bestowed by women, in different states of life, as shown by the table at foot.*

There is a decided preponderance of charitable offerings in the south-eastern departments of France, as compared with the others; the smallest number being shared by the central and western provinces.

With a slight exception, it appears that in those departments where the Catholic clergy are most numerous, and which at the same time present the highest proportion of crimes against the person, and of illegitimate births, the greatest benevolence is manifested towards the poor, both in gifts and bequests. In this coincidence, M. G. traces the influence of the peculiar manners and character, which distinguish in so many other respects the inhabitants of the south of France.

Those departments in which public instruction is least diffused, are also the most scanty in their benefactions to the *clergy*, still more so to the *poor*.

2. Benefactions to the clergy and religious establishments constitute nearly a moiety of the total number. The larger proportion of these are contributed by men, though the contrary has often been affirmed. M. G. corrects a popular error, that the clergy receive more by legacies than in benefactions from the living, the fact being otherwise.

The same rule obtains in respect to this as to the former class of benefactions, when made by women. By contributions during life, married women give more than spinsters, and the latter than widows: in their *bequests* the order is reversed. (See table No. 7.)

* No. 7. *Benefactions by Women.*

CLASSES.	To the Poor.		To Religious Establishments.	
	Gifts.	Bequests.	Gifts.	Bequests.
Married Women.	38	25	41	24
Unmarried.....	33	36	31	38
Widows	29	39	28	38
	100	100	100	100

The benefactions to *Protestant* establishments bear a very small ratio to the total number, not more than 1 in 150. But, although the Protestants give less in proportion than the Catholics to the poor, they not unfrequently lend support to the Catholic institutions as well as to their own, and their benefactions to schools are proportionally the most numerous.

With the slight exception offered by some departments of Brittany and the south, it is in those parts of the kingdom which are most rich and enlightened, and which have long been distinguished by their liberal elections and industry, that we find the greatest number of benefactions towards *religious establishments.*

3. *Schools.* Donations for the support of public schools are in France the rarest of all. They do not exceed 1-30 of the total number of benefactions, whilst in England, says M. Guerry, where such aid is less necessary, (?) they constitute 1-3 of the whole.

Schools, like the clergy, receive more from living benefactors than in bequests, and more from men than women. Whether by donations in life time or by legacies, spinsters are found to give more to schools than married women or widows.

Anonymous donors to schools are proportionally five times more numerous, than among benefactors to the clergy. In the north-eastern departments of France, where it is well known instruction most prevails, the donations to schools are most numerous, particularly in Franche-Comtè, and Normandy.

There are 17 departments in which, during a period of *ten years,* not a single bequest has been made in favour of schools. Thirteen of these are in the western and central divisions, and eleven of them lie contiguous to each other. Throughout all of them, it is almost unnecessary to add, instruction is at its lowest pitch.

A few departments in the north-west and south may stand comparison with the most enlightened districts in their support of schools. This favourable result M. Guerry ascribes in part to the *statistical account* published some years since, of the neglected state of primary instruction in those parts of the kingdom, by which a stimulus has been given to efforts of amelioration.*

Suicides.

For some time past, Suicide has ceased to be considered as a fit subject

* It would be a curious inquiry, and probably productive of many useful results, to follow out the idea suggested by the following statement of Mr. Simpson's: "The *entire generation* is apt to take credit for the institutions of charity. The subscription lists tell a different tale. It has been observed, that about 1500 *known* individuals, of the 150,000 of which Edinburgh is composed, support all the charitable establishments of the place. The London proportion would be 15,000. It would be interesting to know how the fact stands,—*charity* balls and musical festivals of course excluded."—On Pop. Educ. p. 56.

for legislative interference in France; but it is not the less a matter of deep interest to the moralist and the statesman, to be furnished with accurate details relative to this species of moral malady;—a malady so fatal, as to snatch from their families and country almost 2000 individuals every year, the greater part of whom are in the flower of their age.

It is a duty seriously incumbent on the superior government, to collect the facts, and publish periodical statements on this subject. By the official returns, the number of suicides throughout France in the four years 1827-1830 amounted to 6900, or nearly 1800 annually; but M. G. considers it out of doubt that the suicides actually committed are nearly double this number. But, taking even the lowest estimate, which is at least treble the number of *murders* committed in a like period, it would appear that when a death occurs in France from violence, (excluding accidents and involuntary homicides) the probability is as 3 to 1 that the victim has fallen by his own hand, rather than by the hand of another.

The *geographical distribution* of suicides is not less regular than that of other crimes, both against person and property; as is shewn by the following table.

No. 8. *Suicides.*

REGIONS.	1827	1828	1829	1830	Mean Number in 100.	Proportion of Suicides to Population.	
North ..	51 ..	48 ..	54 ..	51	51	1 to 9,853	Inhabitants.
East....	17 ..	16 ..	15 ..	14	16	.. 21,734	
South...	14 ..	15 ..	12 ..	12	13	.. 30,499	
West...	11 ..	11 ..	11 ..	11	11	.. 30,876	
Centre..	9 ..	10 ..	8 ..	10	9	.. 27,393	
	100	100	100	100	100		
	Mean of all France..				.. ..	1 to 18,320	

It will be seen from this table that during these four years, the annual proportion of suicides in either region has not varied more than 3-100 from the mean. In the centre, the variation has not exceeded 1-100; and in the west the proportion for each of the fourteen years is uniform.

The different regions do not stand quite in the same order, as to their proportions of suicides absolutely taken, as when these are compared with their respective population; but in either case, the northern departments are sadly distinguished by an excessive number. Next follows the east, then the centre, south, and west. In the two latter regions, suicides are in general thrice as rare as in the north.

The disproportion among the departments individually, is still more striking. Thus, in that of the Seine, the suicides are as 1 to 3500 inhabitants; in the Higher Pyrenees, only as 1 to 220,000. Between these

extremes, range the other 84 departments; the mean for the whole of France is as 1 to 18,320 of the population. There are 27 departments in which the proportion is greater; 59 in which it is less.

The department of the Seine, comprising the capital, in which 1-6 of the illegitimate births occur, exhibits a similar proportion in respect to suicides. In this one department there occur as many suicides as in 32 departments of the south and centre.

As a general fact, it is very remarkable that in the line of approach to Paris from every quarter, the number of suicides regularly increases as we get nearer to the capital. Something of the same kind is observed in the vicinity of Marseilles, which seems to stand relatively to Provence and Dauphiny, in much the same position as Paris to the rest of France.*

The mixture of rudeness and irascibility, which in the southern provinces causes so many sudden broils, might be supposed to favour the commission of suicide. Facts, however, prove that the departments in which personal outrages are most frequent, are exactly those in which suicides are the fewest, and *vice versâ.*

M. G. offers some interesting reflections on the predominating motives to suicide, and suggests an analysis of the papers so generally left by the unhappy victims, as a means of estimating the relative frequency or degree of activity of the causes of self-murder. He gives a sketch of such an analysis of 100 documents in the archives of the Prefecture of Police, but we cannot enter into the details. One of the inducements to suicide recorded in his table, appears not a little singular,—*the desire to obtain the prayers of the church:* but apparent inconsistencies of this kind are more frequent than we might anticipate. Many suicides sign themselves with the cross before terminating their existence; others throw themselves on their knees and make their prayers, or adorn themselves with beads, and peruse books of devotion.

Though nothing can appear more accidental and uncertain than the *mode* that will be chosen by a person about to terminate his life, it will be

* As about 1-3 of the population of Paris consists of *strangers*, it is interesting to know in what proportions the natives and inhabitants of the different departments become suicides *in that city.* A curious table is given by M. G. to elucidate this point, and it is remarkable that of 1000 suicides in Paris, the proportions for the 12 departments which rank first in the *Parisian* list, nearly correspond with those assigned to them when compared with the country at large. The distribution of *Parisian* suicides among the *five regions* gives a still more striking result. Of 1000 suicides committed in Paris, there belong to the

North	505
East	210
Centre	168
West.....	65
South	52
	1000

In this table the five regions maintain the same order (excepting only the transposition of the west and south) as in the general table, No. 8, for the whole kingdom. The northern region (after taking out the department of the Seine) still produces more than half the total number.

found that chance has no more operation in this case than in the distribution of crimes, or the other general facts of Statistics. The choice is influenced by age, sex, social condition, and a multitude of other circumstances very difficult to distinguish, but very traceable in the constancy of their results.*

On the average of suicides occurring at any given period of life, it is found that choice is made of one mode of destruction in a very marked degree of preference to others. Thus, in youth, says M. G. a man hangs himself; in maturer age recourse is had to a deadly weapon; and as his vigour declines, the first means again come into favour, and it is generally by suspension that an old man puts an end to life. These results are illustrated by the table at foot;† and the more numerous, says M. Guerry, are our observations on this subject, the greater we shall find the constancy of the proportions given.

Instruction.

Having thus presented more or less in detail the facts and inferences which M. G. furnishes on the other subjects comprised in the department of "Moral Statistics," we come now, and in the last place, to a review of the Statistics of *Instruction* in France. The basis on which our author's calculations are founded requires specific notice. In 1823 public attention in France was directed by the illustrious geographer M. Malte Brun, to the remarkable difference in respect to instruction, between different parts of the kingdom, whence arose the distinction of "*La France obscure,*' and "*La France éclairée.*" We are indebted, however, for the first statistical documents on this subject, to the learned Venetian geographer M. Balbi, published in his work, "Statistique du Royaume de Portugal et d'Algarve." The only basis of calculation then possessed, or which has been used by later inquirers, (except M. Guerry) was the number of pupils of the male sex admitted into the public schools. But M. G. thinks

* "When we pass from individuals to masses, we find even in those actions which seem most fortuitous, a regularity of production, an order of succession, that can only arise from fixity of cause."—For. Quar. Rev. xvi. 213.

† No. 9. *Suicides.*

Age of victims.	Of 1000 Suicides	
	By Pistol.	By Hanging.
From 10 to 20 years..	61	68
20 to 30	283	51
30 to 40	182	94
40 to 50	150	188
50 to 60	161	256
60 to 70	126	235
Above 70	37	108
	1000	1000

that the distribution of instruction can now be determined from better data. Since 1827, the Minister of War has subjected all the young men drawn for the army to an examination, which shows the number of those who can read and write at the period of their being drawn. Taking these results for three years as a basis, M. G. has constructed tables exhibiting the relative state of instruction in the different departments. If to illustrate the same facts, we take a map of France, and shade it in proportion to the scantiness of instruction, we shall find a strong line of demarcation between the northern and southern provinces. When the line is drawn from La Manche in the north-west, to the department of the Jura in the east, it will be found that an almost uniform light tint overspreads twenty departments in the northern part of the kingdom. The most favourable proportion in this division is presented by the department of the *Meuse,* in which 74 out of 100 conscripts can *read and write;* and the lowest proportion in this division is found in the "département du Nord," where only 45 out of 100 conscripts are equally advanced.

The southern provinces are not (as has been supposed) those in which ignorance most prevails, but rather the provinces of the west and centre, Berry, Limousin, and Brittany. In the department of Finisterre, only 15 out of 100 conscripts could read and write, in Morbihan 14, and in Corrèze only 12,—this department being the lowest of all in the scale.

In five departments of the west the amount of instruction is above the average of the kingdom. In Corsica, where ignorance has been supposed greatly to prevail, about half of the youthful conscripts can read and write. In 60 departments the average is below this.

The average amount of instruction throughout the 86 departments is expressed by the proportion of 38 out of 100 conscripts, able to *read and write.* There are 44 departments above this mean, 42 below it.

Taking the facts as M. G. has stated them, we have now to advert to his views on the important question, "How far is the state of *crime* influenced by the state of *instruction?*" No question can be more interesting to the philanthropist, none more important to the legislator. Whatever *à priori* opinions we may entertain, it is not the less necessary we should attend to the evidence of *facts.* In this way only shall we acquire an energetic conviction of the utility of our labours, or find a safeguard against undue confidence in certain processes and machinery, which may delude us under the fair name of being that which *it really is not.*

Some of M. G.'s conclusions on this subject are opposed to what is now both the popular and (we hope to show) the only correct opinion: but we must not give the less credit to his principles or love of truth, because a more extended comparison of facts may lead us to differ from him.

In proof of the position that ignorance is the principal cause of crime, it is asserted that the departments in which instruction is least diffused, are those in which most crimes are committed. But M. Guerry joins issue

on the *fact*. On examining the condition of the several departments, it appears that the maximum amount of crimes against the *person* is found in Corsica, in the provinces of the south-east, and in Alsace. But it is *not* in these parts that ignorance is most prevalent. On the other hand, the minimum of this class of crimes is found in the western and central provinces, where certainly instruction is not the most diffused. With respect to offences against *property*, M. G. considers it unnecessary to institute a similar comparison, as this class of crimes is confessedly most prevalent in the best instructed districts; and for a long time past it has been admitted that these crimes should not be attributed chiefly to ignorance, as it has been customary to do.

From an examination of the official records, our author is led to believe that a larger proportion of the crimes against the *person* than of those against *property*, are committed by parties who have received instruction. Again, the proportion of those brought to trial who are unable to read, proves nothing as to the effect of ignorance, unless we can show that the bulk of the population, of which these criminals form part, is in a more advanced state of instruction.* Nor does there appear sufficient evidence for concluding that the ratio of *youthful* convicts has progressively decreased, as instruction has been diffused.

"All these results, unexpected as they are," says M. Guerry, "were not our researches limited to France, we could show to agree with those obtained by men of great probity and intelligence, who have instituted inquiries in the most enlightened communities. In England, in Germany, and in the United States, where some years since all was congratulation on the happy influence of instruction and industry on moral advancement; it is now admitted that to found schools is not enough to check demoralization, and that some other remedy must be sought to extirpate the evils that oppress society."†

* "We are always told that the majority of criminals cannot *read*, as if the mere faculty of reading would have diminished the number of criminals.... But if the investigation had gone the length of ascertaining with which of the criminals had an attempt at moral training and useful knowledge ever been made, we should have found *that* column of the table a blank, and something like cause and effect would begin to dawn upon us."—Simpson, p. 35.

† This reference to the experience of the United States is supported by a communication made to M. Guerry by M. M. G. de Beaumont and A. de Tocqueville, two magistrates of the Royal Court of Paris, whose attention during a visit to North America was particularly given to the working of the penitentiary system, and the general state of crime. Their work, "*Du Système Pénitentiare des Etats Unis*," which at the time M. G. wrote was unpublished, has since been given to the world, and has conferred a high character for intelligence and fairness on its authors. After noticing the care of the state governments of New York and Connecticut to spread education, notwithstanding which (in the latter state particularly) crimes have continued to increase with extreme rapidity, M. M. Beaumont and De Tocqueville acknowledge that if this increased prevalence of crime is not to be attributed to the

"Perhaps," adds M. G. in the true spirit of a philosopher, "we shall be reproached with overturning theories of long standing, and consecrated by the most respectable authority. Our reply is, that we are not concerned with any *theory (nous ne faisons point de doctrine)* :—our task is to bring forward *facts* without professing to explain them. We are also fully convinced that every error cannot but be ultimately pernicious; and that if we would advance science, or benefit our fellow-men, we must bend the authority of names to that of facts, and never sacrifice to secondary considerations what bears the character of a truth."

"Are we to conclude," he next asks, "from the foregoing remarks, that the cultivation of the intellect, instead of weakening criminal propensities, tends rather to strengthen them? This would be to fall into a new error."

"Knowledge, properly considered, is a mere instrument, of which either a good or a bad use may be made. Such as is given in our elementary schools, and is limited to an imperfect acquisition of the arts of reading and writing, cannot supply the place of *education,* and seems quite unfit to exercise much influence on the moral character. The correct opinion seems to be, that it renders the pupil neither better nor worse; for it is not easy to understand how the training a child to certain almost mechanical operations, can possibly in itself be the means of giving him correct habits, or of developing in him sentiments of honour and probity."

With these views, however, our author is far from representing such elementary knowledge as without its use, and he attributes much praise to those honourable and disinterested men,

"*Statists* indeed and lovers of their country,"

who during the last fifteen years have been endeavouring to diffuse it.

diffusion of knowledge, we are yet compelled to admit that this has not sufficed to repress crime. Their concluding reflections I will offer in their own words: "Instruction," say they, "even when comprising religious belief, gives birth to a multitude of new desires, which, unsatisfied, may lead those who experience them into crime. Knowledge multiplies the social relations: it is the soul of commerce and of industry; but thus it creates also a thousand occasions of fraud, which do not exist among a rude and ignorant people. The tendency of instruction is therefore rather to increase than to diminish the number of crimes. In the present day this result is generally admitted, for we find in Europe that crimes are progressive in most of the countries where instruction is most diffused. On the other hand," say these gentlemen, "we will take this occasion to give a complete idea of what we think of the influence of instruction. Its advantages appear to us infinitely to outweigh its inconveniences. It stimulates every variety of intellect, and lends support to all the industrial arts. It thus gives security to the moral sentiments and the material well-being of a people. The passions which it excites, though injurious to society when unable to find objects to satisfy them, become pregnant with advantages when they can attain their desired ends. Thus instruction, it is true, may scatter some seeds of corruption among men; but it is that also which advances a people in wealth and strength. And in a community surrounded by enlightened nations, it is not only a benefit, but even a necessity of state."—Du Syst. Pénitent. par. 1, ch. iii.

"If the instruction," he concludes, "hitherto attempted has not produced all the benefits anticipated, it has at least destroyed many absurd and injurious prejudices; it has given some orderly habits; it has favoured the application of the working classes to the less onerous employments, and has thus tended to mitigate and improve their social condition."

We have preferred presenting M. Guerry's views on this important topic in a complete state, that no one may conclude from his strict adherence to the guidance of facts, that he is opposed to the cause of public education.* It is proper however to state some circumstances which tend to modify the conclusions adopted by our author, respecting the influence of instruction on crime, and which may be found more in detail in an article in the "Companion to the British Almanac for 1835" (p. 53). M. G.'s data then we must observe, show but imperfectly the intellectual condition of the *whole people*, inasmuch as they tell us nothing respecting the state of instruction of females, as they include only young men of the ages at which they are liable to be drawn for the army; and above all, as no distinction is shown in the returns made to the Minister of War, of the number of conscripts who have received instruction *beyond* reading and writing. Now it is shown very satisfactorily in the Essay just referred to, that the average number of *convictions* among the *instructed class* being 1592 annually, (which is rather a smaller number than M. G.'s ratio of 38 instructed to 100 inhabitants should produce) the proportions in which these 1592 had enjoyed the different degrees of instruction stand thus:

No. 10. *Instructed Convicts.*

STATE OF INSTRUCTION.	Number Convicted.	Proportion in 100.	Proportion to whole Populn (32,561,463)
Able to read *or* write imperfectly ..	1140	72	1 to 28,562
.. *and* .. well	388	24	.. 83,921
Instructed beyond reading and writing	64	4	.. 508,773
	1592	100	1 to 20,453 Mean

As the proportion of the *convicted* to the *committals* is smaller among the better *instructed* criminals, it is evident that so far the basis on which M. G. calculates the distribution of crime, viz. the number of the *accused*, is unfavourable to an exact estimate of the influence of instruction. Again, when we examine the intellectual condition of persons accused as *relapsed*

* "This opposition comes of the imperfection of the education of those who show it;—an imperfection that has other bitter fruits. The only excuse for it is the ignorance of these opinionists of the length, and breadth, and height, and depth, of the social error which they ['by incogitate habit'] espouse and circulate."—Simpson, p. 37.

criminals, the result is decidedly in favour of the good tendency of instruction. On the average of four years, 1829 to 1832, the annual number of relapsed criminals amounts to 1357, who are distributed into four classes, as follows :

No. 11. *Relapsed Criminals (Les Récidives).*

CLASSES.	Number Accused.	Number Acquitted.	Per Cent.
Wholly uninstructed	836	168 or	$20\frac{1}{10}$
Able to read *or* write imperfectly	374	85 ..	$22\frac{7}{10}$
.. *and* .. well.....	125	36 ..	$28\frac{8}{10}$
Instructed beyond reading and writing ..	22	9 ..	$41\frac{3}{10}$
	1357	298	22 Mean

As the proportion of relapsed criminals who were *acquitted* in each class, increases with their degree of information, it seems to be proved that however overcome for a time by the force of temptation, instruction *has* a tendency to make the experience of punishment profitable to the offender.

In comparing the several Departments as to the number of criminals which they furnish, and the degree of instruction which they have received, we must bear in mind the wide diversities of character in the inhabitants of the different provinces, which must materially affect their susceptibility of the influence of education, so far at least as certain crimes and propensities are concerned. But it appears even from M. G.'s data, that if instruction has not invariably a marked effect in the repression of crime, yet that it cannot be visited with the reproach of disposing men to criminal acts. The writer of the article already referred to,* after contrasting together four of the *most* with four of the *least* enlightened departments, from the two extremes of the scale, and showing that in the latter where instruction is most neglected, crime is by no means least prevalent, (and so reciprocally in the other four) justly concludes :

" It is here seen that not only is the proportion of criminals to the entire population smallest in the best-instructed districts, but the nature of the crimes committed is less serious :—a result which cannot fail to prove satisfactory to those who look to the cultivation of the minds of their fellow-citizens, as to the surest means of redeeming them from vicious habits."†

* Companion to the Almanac, *ut supra.*

† These remarks are so fully confirmed by Mr. W. R. Greg's valuable "Report on the Social Statistics of the Netherlands," (read at the last meeting of the British Association in Dublin) and his conclusions are altogether so important, that it would be unpardonable to omit giving them in detail. The following table relates to the

It is quite true that these results do not invalidate M. G.'s proofs that on a comparison of larger districts, their moral condition does not correspond very closely to the degree in which they enjoy elementary instruction. But on the other hand, were we even to admit, as M. M. Beaumont and De Tocqueville say, "that it is in the nature of instruction rather to increase than to diminish the number of crimes," we should be justified in looking upon this as only a temporary and incidental consequence. The balance of good would still remain on the other side: nor are we to regard the

kingdom of the Netherlands, which Mr. Greg divides statistically into four divisions according to the degree of instruction in each :—

DISTRICTS.	Per Centage of the Popul^{n} at Schools.	One Murder, Rape, or Violent Assault to Inhabitants.
In the 5 first provinces where ..	13.9	52.960
.. 5 next	11.5	43.380
.. 5 next	10.3	31.700
.. 4 last	7.9	20.720

"Thus we *do* find," adds Mr. Greg, "that where the greatest quantum of education exists, the more heinous crimes of violence diminish in frequency. Upon crimes of *fraud* I should doubt any effect being produced, (appreciable by similar tables) as the causes of these depend often less on the individual, if we may so speak, than on the circumstances by which he is surrounded.

"The fairest and most satisfactory mode however of ascertaining the effect of education in diminishing crime, is to ascertain *the proportion of offenders* who have received instruction. M. Guerry thinks that even in this way no accurate or gratifying result can be arrived at. Let us examine the state of matters in France, Belgium, and America. The data for constructing the following table are taken from M. Quételet and Dr. Lieber, and reduced to centesimal proportions.

Degree of Education of Criminals.	In 1000 Crimes in France against		Crimes agst Per^{n} to Crimes agst Prop^{y} comm^{d} by each class, as 1 to	In 1000 of all kinds of crimes in		
	Property.	Person.		France.	Belgium.	America.
None	616	583	3.2	610	610	256
Very imperfect..	262	282	2.8	266	150	551
Decent	103	113	2.7	103	200	180
Superior	19	22	2.6	21	40	13
	1000	1000	..	1000	1000	1000

"Two conclusions are to be drawn from this table which has been constructed with the greatest care.

"1. That 81 *per cent.* of the crimes are committed by persons having received no education, or a very imperfect one; and only 19 *per cent.* by those having had the benefit of a decent or a superior one.

"2. That the best educated commit *proportionally* more crimes of violence than of fraud. This is natural, inasmuch as while their passions are equally strong, their temptations to theft are incomparably less than those of the ignorant, who are generally also the poor. Nor must this be considered as in any way contradicting the last table. The two combined prove :—1. That crimes of violence diminish in proportion as education increases. And 2. That crimes of fraud diminish in a still more rapid ratio."—Report, &c. pp. 26, 27.

partial evils of popular instruction as the only ill effects attributable to mental culture and the progress of civilization, which nevertheless are accounted blessings by every sane mind.*

From some of his remarks already quoted, it is evident that M. G. is aware with what caution the inferences resulting from the existing state of *instruction* are to be extended to the influence of what is rightly termed *education.* He alludes to the general oversight of the wide difference which exists in the kind of mental culture respectively indicated by these terms; a distinction however which has not escaped notice by some of the most eminent of the French publicists. In a lecture delivered in 1817, M. Royer Collard strongly insists upon it in these words: "Sans l'éducation, l'instruction ne serait qu'un instrument de ruine....Les mœurs naissent de l'éducation, l'éducation seule les crée et les perpétue, parceque seule elle enseigne véritablement le devoir *en le réduissant en pratique.*"

These remarks give us a clue to much of the contrariety of opinion prevalent on this subject, both in France and our own country. The idea is too absurd to merit formal refutation, that a creature endowed with the faculties of *man,* is intended to find his happiness and welfare in the neglect of that very portion of his nature which marks his superiority to other animated beings.† It is in fact nothing less than a libel on the Divine wisdom, to suppose that there breathes one human being gifted with understanding, conscience, and will, to whom education must not be an invaluable blessing. But then comes the momentous enquiry what *is* education? Is it the mere acquisition by rote of certain facts or moral lessons, whilst the intellect is unexercised, and the habits undisciplined? Or on the other hand, is it the infusion of knowledge and cultivation of the reasoning powers, to the neglect of the moral affections of our nature and of the sense of *responsibility,* which is the cement of human society? Either of these methods may be called *instruction* as respects certain powers and portions of our nature; but to neither of them singly should we apply the term *education,* which is not a partial and incomplete work, but has reference to

* It is a fact admitted by most writers on insanity, (and particularly noticed in Dr. Prichard's admirable work) that *mental disease* is comparatively rare among *savage* nations, and even unknown among some tribes. "It comes forward," says the Dr. "with the dawning of civilization, and perhaps keeps pace, though its increase is modified by other circumstances, with the advancement of mental cultivation." M. Pariset, an able and eloquent writer on this subject, (quoted by Dr. P.) carries his opinion still further, but justly concludes in words equally applicable to the incidental evils of popular education,—"The more there is of liberty in any country, the more numerous are the chances of derangement; but this does not prevent our allowing that liberty is favourable also to the expansion of human reason."—Prichard on Insanity, pp. 340, 351.

† "The animals are guided aright by their instincts: man ought to be directed as truly by his observing and reflecting powers, which were given him for that end; but then the condition of cultivation and improvement was annexed to the gift, and that command of the All-wise is forgotten and disobeyed."—Simpson, p. 13.

all the faculties and affections of the mind, and must *bring out* the *whole man* into the full and efficient exercise of his capacities and duties.* As virtue then consists not merely in a knowledge of what is right, but in a corresponding habit of action, we must not look for disproportionate results when instruction is confined to the arts of reading and writing. "A book," says a judicious writer,† "informs us what habits ought to be—right education insures a number of *acts* in accordance with the principle laid down in the book." Rote learning can never reach the active principles that govern the conduct, or the teaching of texts and rules be an effectual substitute for *moral training*, education's paramount object. No system in short can fulfil the design of a sound education, which, while it inculcates the acquisition of knowledge and the exercise of the intellect, does not aim also at bringing the moral nature (as Sir James Mackintosh has beautifully said) "to look on the understanding itself as something that is only the first of its instruments." The whole constitution of nature, and its admirable adaptation to the faculties of man as a moral, intelligent, and religious being, point to the conclusion that rectitude is the only way of securing happiness. If this is truth for the individual, it is no less truth for the community, and it should be the polar star of all efforts for social amelioration. The finest state machinery must be subject to derangement, unless the parts are so shapen and proportioned as to work harmoniously, and with a due dependence on each other. Overlooking this truth, many patriotic and enlightened men, in whose view the political constitution of a country was every thing, have seen their labours end in failure and disappointment. Their minds in fact have forerun their age, and over-rated the materials with which they had to work, forgetful of the principle, so well stated by an able writer,‡ that "no political arrangements can transmute the effects of ignorance into those of knowledge; or bring it to pass that an unenlightened people can be as well governed under free institutions as an enlightened one."§

* "A plan of education may be devised which shall be admirably adapted for opening and invigorating the *intellect*, when viewed in itself. But how shall we get it to be acted on? How shall we ensure the development of the intellect, unless we interest also those feelings which, in the complex being man, are inseparably combined with the intellectual powers? since it is not reason that thinks and judges and infers, but reasoning man;—not the abstract principle of intellect, but intellect as it physically exists, and as it is modified and controlled by our active and sensitive nature."—Dr. Hampden, Lect. on Mor. Phil. p. 60.

† Quarterly Journal of Education, No. 18.

‡ The Rationale of Political Representation, p. 216.

§ "Every one who has anything to lose which is worth the keeping, is a gainer by the education of the poorer classes. The safety of your Lordship's property, the well-being of society, the public security, depend upon the christian education of those classes."—Bp. of London's Speech on the Irish Church Bill, Aug. 24, 1835, p. 8.

We may add to this Mr. Simpson's axiom, "*There is but one time for moral training, and that is infancy.*"—p. 133.

When Milton took it in hand to write "of the reforming of education," he treats it as "one of the greatest and noblest designs that can be thought on, and for the want whereof this nation perishes." And he aimed at nothing less than "to point out the right path of a *virtuous and noble education*, laborious indeed at the first ascent, but else so smooth, so green, so full of goodly prospect and melodious sounds on every side, that the harp of Orpheus was not more charming."* Since the time of our divine poet, we may hope that a partial advance has been made to the attainment of this "goodly prospect;" but as respects the great bulk of the youthful population, we have yet to discover and agree upon the best mode of imparting to them a virtuous and noble education;†—an education which shall give the children of every class an accurate knowledge of their true position in society, and shall impress them with the conviction, that "all their faculties and blessings, their senses, talents, and reason, are held either for use or abuse; either to be ill or well employed: and that they will accordingly reap the fruits, either of their diligence or of their neglect."

This is not the place to discuss the question of the expediency of compulsory education by the state;—"a question which seems dependent on the general circumstances of a country, and which must be determined by social and political diversities rather than by universal and inflexible principles." But without calling for its interference to such an extent as this, we may consistently urge the duty of the state to promote the cause of education in other ways, particularly by grants in aid of voluntary donations, and by the establishment of Normal schools for the education of *well-qualified teachers*. At present we have masters to teach what they know but indifferently themselves, and one of the highest offices a human being can perform is frequently entrusted to persons who can bring no certificate of their proficiency, and whose low qualifications effectually degrade what should be a high and honourable profession.‡ "It is the

* Letter to Mr. Samuel Hartlib, 1650.

† Less perhaps to *discover* than to *realize*. The complete and luminous developement of the *principles* of a sound education suited to all classes,—in its threefold division of physical, intellectual, and moral,—for which we are indebted to Mr. Simpson, must leave us as a people without excuse in continuing longer in the old ways, which in this instance at least, experience proves to be those of error and disappointment. No one can rise from the perusal of Mr. S.'s work without the conviction that he has laid open the true path to national improvement, and that if we neglect longer the manly culture of the popular mind, "the sin lieth at our door." Were not Mr. S. "one who is above the pursuit of praise," the cordial admiration of his labours which his countrymen have publicly expressed, would be all that he could desire: but his enlightened patriotism will find its best reward in the testimony of conscience and in the anticipation of those blessings, which his country will ultimately derive from his exertions.

‡ "Until some care be taken to give the same security by law for the health of the mind, as is given for the health of the body; until schoolmasters are subjected

cautious and systematic selection of persons adapted for the office of teachers (says Mrs. Trollope, alluding to the Prussian system,) which can alone ensure a profitable national education."* "No system (says Professor Pillans) would work well without a good master, and it is upon this account that I conceive the institution of *schools for masters* to be at the foundation of all improvement in national education."† Another important step (as many writers have suggested)‡ would be the appointment of a *public functionary*, invested with similiar powers to those of the French Minister of Instruction, or of the Superintendant of common schools in the state of New York, who might give his undivided attention to those duties at present very partially and imperfectly discharged by the Home Department. Such an officer would find ample employment for a time in the collection of the *Statistics of education;* and besides his attention to the establishment of schools, he should have to watch over the working of them, to "improve their system of superintendence and plans of instruction, and to extend their sphere of action to the very limit of their means." An early result of the establishment of such an office, it is said, "would be to make the fact as well-known to ourselves as it already is to our neighbours, that in few countries of Europe are the elements of a *sound and useful instruction* so scantily diffused as in England and the sister island."§ The Select Committee on secondary punishments (of 1831) in noticing the general conduct of criminals in London, state that "most of them can read and write, but they are excessively *ignorant*; their reading and writing gives them no sort of knowledge; it is the same as if they could not read or write *as to any useful knowledge.*"||

to at least as rigid a scrutiny as apothecaries, it is perfect nonsense to talk of education having failed to check the progress of crime in England,".... "a country, by the way, in which the science of education is at a lower ebb than in any other civilized nation on the earth."—For. Quar. Rev. Oct. 1835.

* Belgium ii. 169.

† "A crazy and ragged orator some time ago applied at the Mansion House for a few shillings and a pair of shoes, to take him *back* to Ireland, seeing he had found the pretensions of this island to learning exceedingly hollow. In his harangue to the Lord Mayor, he observed with exquisite and most appropriate sarcasm, 'that he had heard much of the schoolmaster being abroad in England, but that he had not had the good fortune to find any body *who had met with him!*"—Simpson, p. 185.

‡ Quar. Jour. Ed.—Edinb. Rev. No. 117.—Simpson on Education, 214, &c.

§ Quar. Jour. Ed. No. 18, p. 327.

|| Guerry, p. 49.

"It forms an instructive example of the sedative effect of established habits of thinking, that our ancestors and ourselves have so contentedly held THIS to be education, or the shadow of it, for any rank of society! Reading, writing, and ciphering, are mere instruments: when attained, as they rarely or never are after all, by the working class to a reasonable perfection, they leave the pupil exactly in the situation where he would find himself, were we to put tools into his hands, the

With what success a national system of a far superior character to any with which we are familiar can be established and worked, is shown in the admirable report of Victor Cousin on the Prussian system of education,—a system beyond doubt, though not perfect,* the most vigorous and complete that has hitherto been put in operation on an extensive scale.† We are bound therefore to anticipate that in due time its results will be proportionately beneficial, and that an improved state of public morals will be shown even by the criminal records of that country.

But, in judging of the value of education by the *state of crime* in any community, it must be recollected that we are supplying at best but a *negative* test. It is almost impossible to appreciate the influence of the other causes simultaneously operating on public morals, and which may either neutralize the good effects of education, or positively outweigh them on the opposite side. Thus education may appear in some instances to have exercised little influence on the state of crime, where nevertheless, could we abstract that influence, other circumstances being unchanged, the moral condition of the people would have been even *worse* than we find it. We have seen that in the *northern* region of France, where instruction is far more prevalent than in the *centre*, the crimes against *property* relatively to the population are at least twice as numerous; but it is in the northern region also, although most abounding in *wealth* (and of course in temptations and opportunities for theft) that *pauperism* is most prevalent; and it is fair to conclude, that indigence and misery are the chief causes of its disproportionate share of crimes, which, under such circumstances, might be even *more* numerous were not instruction so generally diffused as it is. On the other hand, criminal statistics afford us no direct means of judging of the influence of education in civilizing and refining the manners, in creating new sources of occupation and enjoyment, and in repressing many vicious habits which materially interfere with the happiness and welfare of a community, though they may not be considered in our estimate of *crime*. The influence of instruction in this way is quiet and unnoticed, but we cannot doubt that it is powerful and extensive. This is true of even the first elements of education, as he that can read is at once made

use of which however he must learn as he may.... If a national system of education is to stop here, it would save much trouble and after disappointment not to attempt it at all."—Simpson, pp. 34, 35.

* See Mr. Simpson's strictures on the too exclusive importance allotted to the machinery, &c. pp. 215, 224.

† France is proceeding rapidly in the establishment of a similar system, with such modifications as to the enlightened superintendence of M. Guizot seem desirable. The grant of 1833 for national education was £600,000. The British legislature in the same year voted £20,000 for the same purpose,—a sum, as Mr. Simpson well remarks, only valuable as "an evidence of the *animus* of the government, and as a test of the feelings of the public."—p. 263.

more independent of extrinsic sources of enjoyment, and may learn to find in

> "*books*—a real world
> Round which, with tendrils strong as flesh and blood,
> His pastime and his happiness may grow."

"It is for want of innocent recreation," says a periodical writer already quoted,* "that the gin shop and ale-house are frequented: *unemployed* man requires *some* stimulant: he cannot work all his time, and if for want of instruction, he has not the power of enjoying pleasures of an innocent description, tippling, as it needs no talents or training, is invariably resorted to. It excites and stimulates; and what if health is impaired? The passing of his time in the enjoyment of even this low pleasure is to him preferable to that *weariness of mind* which proceeds from vacancy."

We must not enlarge further on this topic, which trite as it is, can never be considered by any one alive to the interests of humanity, as of slight importance or devoid of interest. We acknowledge (with Sir James Mackintosh) "that of all the fine arts, the noblest is the art of forming a vigorous, healthy, and beautiful mind;"† and although we have not the satisfaction of yet witnessing all the good effects which we believe education will ultimately produce, we cannot lose our faith in its efficacy to improve mankind. We scruple not therefore to conclude in the language of an eloquent writer‡:—

"That *knowledge* is an appreciable good for every being who is capable of knowledge: a good for the richest—a good for the poorest—a good for all who are placed in any part of the scale between the extremes of wealth and poverty:—that the only danger is, lest it should not be communicated with the requisite universality to the whole mass of the population, and in a sufficient amount to every individual member:—that *ignorance* on the

* Quarterly Journal of Education, No. 18, p. 237.

† Memoirs, i. 428.

‡ British Critic, Jan. 1835, p. 66.

At the risk of transgressing my prescribed bounds, I am tempted to add the following beautiful passage from Hartley Coleridge, as it is pregnant with political and moral wisdom: "Considering man as a person, consider him as *sentient*, *intelligent*, *moral*, and *immortal*. For simply to think of a man as a *sentient* being is inconsistent with that hard-hearted policy which would employ him, reckless of his suffering or enjoyment, like a wedge or a rivet, to build up the idol temple of a false national greatness; to regard him as *intelligent*, or rather as *capable of intelligence*, condemns the system that would keep him in ignorance to serve the purposes of his rulers, as game-cocks are penned up in the dark, that they may fight the better; to regard him as *moral*, corrects the primary conception of national prosperity; and to revere him as *immortal* commands preremptorily that he shall never be made a tool or an instrument to any end in which his own permanent welfare is not included."—Worthies of Yorkshire, p. 7.

contrary is the great degrader, and brutalizer, and corrupter of man ; and that you will do more for the happiness of a human being, and put ampler means and implements and resources of enjoyment within his reach, by simply teaching him to read and write, and giving him a taste for mental pleasures, than by flinging millions of money into his lap and shutting him out at the same time from the pale of intellectual cultivation."

1835. JULY.		HIGH WATER. TIME. h.	m.	HEIGHT. ft.	in.	LOW WATER. TIME. h.	m.	HEIGHT. ft.	in.	WIND.	LUNATIONS. h.	m.
1	A. M.	10	3	32	2							
	P. M.	10	21	32	5	..		..		S. E.		
2	A. M.	10	52	31	10	..		..				
	P. M.	11	8	31	8	5	22	5	9	S. W.		
3	A. M.	11	49	30	7	5	52	6	0			
	P. M.					6	24	6	3	W.	☽ 2	41
4	A. M.	0	10	30	4	6	51	6	4			
	P. M.	0	46	30	1	7	12	6	10	S. W.		
5	A. M.	1	7	30	11	7	59	6	11			
	P. M.	1	44	30	5	8	32	6	10	S. W.		
6	A. M.	2	19	31	6	9	15	6	0			
	P. M.	3	10	35	7					S. W.		
7	A. M.	3	31	35	6							
	P. M.	4	38	36	5	..		..		S. W.		
8	A. M.	4	48	36	4							
	P. M.	5	20	37	4	..		..		S. W.		
9	A. M.	5	43	38	2							
	P. M.	6	7	39	0	..		..		S. W.		
10	A. M.	6	38	38	6							
	P. M.	7	9	39	11	..		..		S. W.	○ 6	37
11	A. M.	7	26	37	5							
	P. M.	8	5	38	3	..		..		S. W.		
12	A. M.	8	33	36	4							
	P. M.	8	44	35	11	..		..		S. W.		
13	A. M.	9	15	34	4							
	P. M.	9	39	34	0	..		..		W.		
14	A. M.	10	12	32	10							
	P. M.	10	27	32	3	..		..		W.		
15	A. M.	10	49	30	7							
	P. M.	11	5	31	0	..		..		S.		
16	A. M.	11	21	30	0	..		..				
	P. M.	11	42	29	3	5	51	0	9	S. W.		
17	A. M.					6	16	0	9			
	P. M.	0	9	28	0	6	21	1	11	S.	☾ 3	44
18	A. M.	0	31	27	2	6	42	2	0			
	P. M.	0	37	26	1	6	48	3	9	S. W.		
19	A. M.	1	18	25	6	7	24	2	10			
	P. M.	1	34	24	3	7	45	4	8	S. W.		
20	A. M.	2	25	25	3	8	35	3	9			
	P. M.	3	12	23	6	9	30	4	5	S. W.		
21	A. M.	4	0	24	9	10	0	2	9			
	P. M.	4	32	24	10	10	45	2	6	N. E.		
22	A. M.	5	3	25	8	11	35	1	5			
	P. M.	5	49	26	10					N. E.		
23	A. M.	6	3	27	2	0	11	1	3			
	P. M.	6	27	28	3					E.		
24	A. M.	6	53	28	9							
	P. M.	7	21	30	3	..		..		E.		
25	A. M.	7	31	30	5							
	P. M.	7	47	30	6	..		..		E.	● 5	14
26	A. M.	8	13	31	1							
	P. M.	8	26	31	9	..		..		E.		
27	A. M.	8	45	31	0							
	P. M.	8	50	33	2	..		..		Variable.		
28	A. M.	9	2	32	5							
	P. M.	9	17	32	9	..		..		W.		
29	A. M.	9	45	31	3							
	P. M.	9	48	32	9	..		..		N. E.		
30	A. M.	10	37	30	11							
	P. M.	10	51	31	1	..		..		Variable.		
31	A. M.	11	24	29	10							
	P. M.	11	36	30	0	..		..		N. E.		

1835. AUGUST.		HIGH WATER. TIME. h.	m.	HEIGHT. ft.	in.	LOW WATER. TIME. h.	m.	HEIGHT. ft.	in.	WIND.	LUNATIONS. h.	m.
1	A. M.											
	P. M.	0	6	30	5	..		..		Variable.	☽ 7	50
2	A. M.	0	20	30	2							
	P. M.	0	59	28	9	..		..		Variable.		
3	A. M.	1	8	27	4							
	P. M.	2	8	26	11	8	20	1	2	N. E.		
4	A. M.	2	33	27	0	8	52	1	0			
	P. M.	3	47	26	8	9	50	1	1	N. E.		
5	A. M.	3	56	27	0	10	23	0	6			
	P. M.	4	35	27	4					S. W.		
6	A. M.	5	4	27	4							
	P. M.	5	40	30	4	..		..		W.		
7	A. M.	6	16	28	0							
	P. M.	6	49	29	7	..		..		N.		
8	A. M.	7	10	29	8							
	P. M.	7	42	31	11	..		..		N.	○ 3	39
9	A. M.	8	3	31	1							
	P. M.	8	14	34	7	..		..		N.		
10	A. M.	8	29	33	3							
	P. M.	8	52	34	4	..		..		S.		
11	A. M.	9	19	33	5							
	P. M.	9	28	34	3	..		..		S.		
12	A. M.	9	42	32	10							
	P. M.	10	6	33	4	..		..		W.		
13	A. M.	10	22	30	9							
	P. M.	10	31	31	1	..		..		N. W.		
14	A. M.	10	42	28	0							
	P. M.	10	50	27	8	..		..		N. E.		
15	A. M.	11	16	27	6							
	P. M.	11	45	26	7	5	49	0	6	W.		
16	A. M.	11	58	25	5	6	13	1	0			
	P. M.					6	13	2	5	W.	☾ 9	15
17	A. M.	0	26	23	9	6	29	2	6			
	P. M.	0	16	23	2	6	42	6	1	N.		
18	A. M.	0	45	22	3	7	0	6	3			
	P. M.	0	58	21	8	7	28	8	9	N. E.		
19	A. M.	2	4	22	2	8	34	7	2			
	P. M.	2	57	22	5	9	43	7	8	N. E.		
20	A. M.	3	48	24	8	10	2	5	9			
	P. M.	4	14	24	5	10	46	4	10	Variable.		
21	A. M.	5	8	27	0	11	33	3	8			
	P. M.	5	39	28	9					S.		
22	A. M.	5	58	29	3	0	6	2	8			
	P. M.	6	24	30	1	0	27	1	9	S. W.		
23	A. M.	6	58	29	0							
	P. M.	7	17	31	11	..		..		S. W.		
24	A. M.	7	30	30	0							
	P. M.	7	40	34	7	..		..		S. W.	● 4	22
25	A. M.	7	54	34	9							
	P. M.	8	13	36	3	..		..		N. W.		
26	A. M.	8	31	35	7							
	P. M.	8	38	36	4	..		..		N. W.		
27	A. M.	8	56	35	7							
	P. M.	9	18	36	3	..		..		N. E.		
28	A. M.	9	29	35	7							
	P. M.	9	44	35	5	..		..		E.		
29	A. M.	10	16	34	4							
	P. M.	10	32	33	7	..		..		N. E.		
30	A. M.	10	55	32	0							
	P. M.	11	9	31	2	..		..		E.		
31	A. M.	11	48	29	1	5	49	0	9			
	P. M.					6	25	1	4	E.	☽ 0	53

1835. SEPTEMBER.		HIGH WATER. TIME.		HIGH WATER. HEIGHT.		LOW WATER. TIME.		LOW WATER. HEIGHT.		WIND.	LUNATIONS.	
		h.	*m.*	*ft.*	*in.*	*h.*	*m.*	*ft.*	*in.*		*h.*	*m.*
1	A. M.	0	23	28	1					E.		
	P. M.	1	7	26	9	..		..				
2	A. M.	1	47	26	5					E.		
	P. M.	2	34	26	4	..		..				
3	A. M.	3	17	26	10					S. E.		
	P. M.	3	56	29	0	..		..				
4	A. M.	4	37	28	7					S. W.		
	P. M.	5	13	30	0	..		..				
5	A. M.	5	39	30	9					W.		
	P. M.	6	10	33	1	..		..				
6	A. M.	6	36	31	0					N. E.		
	P. M.	6	54	34	0	..		..				
7	A. M.	7	4	31	0					E.	○	2 51
	P. M.					..		..				
8	A. M.									S. W.		
	P. M.	..		..		..		..				
9	A. M.									W.		
	P. M.	..		..		..		..				
10	A. M.									W.		
	P. M.	..		..		..		..				
11	A. M.									W.		
	P. M.	..		..		..		..				
12	A. M.									W.		
	P. M.	..		..		..		..				
13	A. M.									N. W.		
	P. M.	..		..		..		..				
14	A. M.									S. W.		
	P. M.	..		..		..		..				
15	A. M.	10	58	25	1					S. W.	☾	3 44
	P. M.	11	32	22	9	5	10	6	3			
16	A. M.					5	42	7	0	S. W.		
	P. M.	0	18	22	4	6	0	11	6			
17	A. M.	1	17	23	5	7	29	11	3	S. W.		
	P. M.	1	38	23	3	8	35	10	3			
18	A. M.	3	10	25	8	9	26	8	2	S.		
	P. M.	3	27	27	9	10	22	6	8			
19	A. M.	4	11	30	2	10	52	5	5	S. W.		
	P. M.	4	42	31	10	11	28	4	1			
20	A. M.	5	15	32	9	11	57	3	6	S. W.		
	P. M.	5	49	34	8							
21	A. M.	5	55	35	4					Variable.		
	P. M.	6	12	36	6	..		..				
22	A. M.	6	38	37	6					S.		
	P. M.	6	47	39	11	..		..			●	2 26
23	A. M.	7	4	39	11					S.		
	P. M.	7	18	40	5	..		..				
24	A. M.	7	42	40	2					S.		
	P. M.	8	4	40	6	..		..				
25	A. M.	8	29	40	2					S.		
	P. M.	8	43	40	4	..		..				
26	A. M.	8	59	38	6					W.		
	P. M.	9	32	38	5	..		..				
27	A. M.	9	56	37	3					S. W.		
	P. M.	10	4	36	5	..		..				
28	A. M.	10	56	33	7	4	20	2	8	S. W.		
	P. M.	11	18	33	5	5	30	2	6			
29	A. M.	11	30	31	4	5	40	5	7	S.	☽	7 8
	P. M.	11	58	29	1	6	0	5	5			
30	A. M.					6	15	6	10	S. E.		
	P. M.	0	33	29	9	6	50	8	8			

1835. OCTOBER.		HIGH WATER. TIME. h. m.	HEIGHT. ft. in.	LOW WATER. TIME. ft. in.	HEIGHT. ft. in.	WIND.	LUNATIONS. h. m.
1	A. M.	1 5	28 9	7 10	9 9	S.	
	P. M.	1 45	28 9	8 45	7 6		
2	A. M.	2 30	29 4	9 30	7 6	S. W.	
	P. M.	3 23	31 9	10 20	4 11		
3	A. M.	4 6	32 3	10 40	4 3	N.	
	P. M.	4 33	34 9				
4	A. M.	4 58	34 8	..	..	W.	
	P. M.	5 27	36 5				
5	A. M.	5 45	36 7	..	..	W.	
	P. M.	6 12	37 9				
6	A. M.	6 32	37 3	..	..	W.	
	P. M.	6 45	38 4				
7	A. M.	6 56	37 6	..	..	E.	☉ 5 0
	P. M.	7 4	37 9				
8	A. M.	7 15	37 1	..	..	E.	
	P. M.	7 26	37 7				
9	A. M.	7 32	37 3	..	..	S. W.	
	P. M.	7 48	37 0				
10	A. M.	7 56	35 4	..	..	N. W.	
	P. M.	8 26	38 0				
11	A. M.	8 27	39 0	..	..	N. W.	
	P. M.	8 45	38 0				
12	A. M.	8 58	38 0			N. W.	
	P. M.	9 56	37 1	4 36	8 10		
13	A. M.	10 0	35 4	4 38	9 2	W.	
	P. M.	10 17	34 4	4 43	11 0		
14	A. M.	10 27	32 10	4 43	11 1	W.	
	P. M.	10 42	30 8	4 47	12 5		
15	A. M.	10 56	29 7	4 53	13 2	W.	☾ 9 53
	P. M.			5 13	14 9		
16	A. M.	0 3	28 0	6 1	15 6	Variable.	
	P. M.	0 48	28 5	7 4	15 1		
17	A. M.	1 51	29 9	8 4	12 9	E.	
	P. M.	2 21	32 4	9 2	10 6		
18	A. M.	3 20	34 3	9 47	8 10	E.	
	P. M.	3 35	36 1	10 39	7 6		
19	A. M.	4 24	37 3			E.	
	P. M.	4 58	34 9	..	..		
20	A. M.	5 25	36 2			S. W.	
	P. M.	7 38	37 3	..	..		
21	A. M.	6 3	38 8			W.	
	P. M.	6 10	39 8	..	..		
22	A. M.	6 30	40 8			S. W.	● 0 17
	P. M.	6 40	40 10	..	..		
23	A. M.	7 18	41 9			S. W.	
	P. M.	7 26	43 5	..	..		
24	A. M.	8 2	42 2			S. W.	
	P. M.	8 17	41 3	..	..		
25	A. M.	8 38	39 9			S. W.	
	P. M.	8 57	40 3	..	..		
26	A. M.	9 45	35 10			S. W.	
	P. M.	10 30	32 7	..	..		
27	A. M.	10 46	31 9			W.	
	P. M.	11 10	30 0	..	..		
28	A. M.	11 32	28 5	5 43	1 9	W.	
	P. M.			6 4	2 5		
29	A. M.	0 1	26 6	6 13	5 4	S. W.	☽ 3 46
	P. M.	0 24	26 2				
30	A. M.	1 32				N. E.	
	P. M.	2 23	..	..	..		
31	A. M.	2 46				S. W.	
	P. M.	3 17	..	..	..		

1835. NOVEMBER.		HIGH WATER. TIME.		HEIGHT.		LOW WATER. TIME.		HEIGHT.		WIND.	LUNATIONS.	
		h.	*m.*	*ft.*	*in.*	*h.*	*m.*	*ft.*	*in.*		*h.*	*m.*
1	A. M.	4	5									
	P. M.	4	19	..		..		..		N. W.		
2	A. M.	4	25									
	P. M.	5	30	..		..		..		N.		
3	A. M.	5	45									
	P. M.	6	10	36	4	..		..		S. E.		
4	A. M.	6	26	36	0							
	P. M.	6	32	36	9	..		..		S. E.		
5	A. M.	6	38	36	6						○ 10	16
	P. M.	7	6	37	3	..		..		E.		
6	A. M.	7	25	37	4							
	P. M.	7	33	37	1	..		..		N. E.		
7	A. M.	8	1	36	4							
	P. M.	8	11	36	1	..		..		S. E.		
8	A. M.	8	39	35	7							
	P. M.	8	45	35	0	..		..		W.		
9	A. M.											
	P. M.	9	10	32	3	..		..		N. E.		
10	A. M.	9	12	31	8							
	P. M.	9	35	30	3	..		..		N. E.		
11	A. M.	9	49	30	2	4	0	3	2			
	P. M.	10	2	29	0	4	10	4	3	N. E.		

Since the last number of this Journal was published, the tide record, a part of which has appeared upon its pages, has furnished data for the construction of tide tables for the port of Bristol. These tables, which are due to the industry—we fear we must add, the disinterested industry—of Mr. Bunt, were constructed partly from the above data, and in part from observations made under Mr. Hilhouse's direction at the Bristol dock gates. To say that they are the best tables extant along the shores of the Bristol Channel, is to say little in their praise: but they have been pronounced by the highest authority upon tydological subjects to be among the best yet calculated in this country; and there seems little doubt but that in a few years they will be superior even to those of Liverpool.

The praise of an expiring journal is even weaker than ordinary praise; but Mr. Bunt will find his best reward in the consciousness of the service that he has rendered to this city, in the saving both of life and property that his tables are likely to effect.

METEOROLOGY.

In presenting to our readers the Meteorological Account for the year 1835, we have considered it might not be uninteresting to many of them to add the tables of the five preceding years, thus enabling those who take an interest in meteorological pursuits to compare the results.

The Annual Meteorological Tables for the Years 1830 *to* 1835 *inclusive, kept on Kingsdown, Bristol.*

	Barometer.		*Therm.*		*Rain.*	*No. of Days.*			*Winds.*								
1830.	Max.	Min.	Max.	Min.	Inch. and Decm	Fair.	Rain.	Snow.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Vrble.
Jan...	30·55	28·84	47	14		17	6	8	8	7	7	4			2	2	1
Feb...	30·29	29·41	58	13		12	9	7	1	6	2	2	3	7	4	3	
March	30·52	29·37	67	25		23	7	1		1	1	7	1	15	3	2	1
April.	30·14	29·18	72	15		13	14	3	3	2		3	3	8	10		1
May..	30·22	29·35	72	33		14	17		2	2	1	4	1	9	7		5
June..	30·05	29·44	73	44		9	21		5	2		1	6	3	6	7	
July..	30·25	29·54	83	47		14	17			2		2	4	1	19	2	1
Augst.	30·21	29·29	74	42		8	23		3	1		1	2	7	11	5	1
Sept..	30·27	29·18	67	39		11	19		2	1			4	9	9	5	
Oct...	30·47	29·78	72	38		22	9		2	1	9	1	2	4	7	5	
Nov..	30·40	28·95	65	27		10	20				5	1	5	11	6	2	
Dec..	30·36	28·97	52	12		12	15	4	6	4	5	4		2	4	6	
Year .	30·55	28·84	83	12		165	177	23	32	29	30	30	31	76	88	39	10

	Barometer.		*Therm.*		*Rain.*	*No. of Days.*			*Winds.*								
1831.	Max.	Min.	Max.	Min.	Inch. and Decm	Fair.	Rain.	Snow.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Vrble.
Jan...	30·56	29·08	50	22	1·90	22	7	2	6	6	10	5	2	2			
Feb. .	30·25	28·95	59	26	1·81	14	11	3	1			2	6	4	6	8	1
March	30·40	29·12	59	29		16	14	1	1	4	2	1	4	7	11	1	
April.	30·44	29·10	67	34	2·18	18	12		2	11	5	2	4	2	2	2	
May..	30·27	29·43	72	29	1·95	22	9		2	6	11	2	2	2	4		2
June..	30·44	29·66	72	44	3·02	17	13		3	1	1		4	6	9	3	3
July..	30·28	29·61	82	49	3·35	16	15		1	3	6	1		10	4	3	3
Augst.	30·27	29·60	79	48	1·94	18	13		8	2	3		4	1	11	2	
Sept..	30·25	29·36	69	42	3·58	13	17		1	5	1	4	4	10	1	3	1
Oct...	30·33	29·23	68	36	3·73	4	27					4	10	15	2		
Nov..	30·50	29·39	58	30	5·05	9	20	1	1	1	2		1	5	14	4	2
Dec. .	30·40	28·84	56	28	4·63	9	22			3	2		8	11	3	3	1
Year .	30·56	28·84	82	22	33·14	178	180	7	26	42	43	21	49	75	67	29	13

	Barometer.		*Therm.*		*Rain.*	*No. of Days.*			*Winds.*								
1832.	Max.	Min.	Max.	Min.	Inch. and Decm	Fair.	Rain.	Snow.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Vrble.
Jan...	30·42	29·32	50	22	0·92	20	9	2	2	2	9	1	4	3	5	5	
Feb. .	30·52	29·20	54	24	0·39	22	7		2	10	1	6	2	3	3	2	
March	30·36	29·92	59	25	2·13	15	16		2	4	1	1	7	2	8	5	1
April.	30·50	29.40	73	32	1·30	18	12		2	7	6	3	3	5	2	1	1
May..	30·41	29·28	75	33	2·60	19	12		3	3	3	1	3	5	4	7	2
June .	30·36	29·45	77	42	1·61	17	13		1	2		2		6	12	6	1
July..	30·36	29·30	79	42	2·13	24	7		2	12	2	1	3	4	1	4	2
Augst.	30·27	29·18	84	42	5·02	14	17			2				21	3	5	
Sept..	30·50	29·60	78	34	0·63	23	7			6		7		6	5	5	1
Oct...	30·58	29·15	67	29	4·07	16	15		1	3	4		1	12	8		2
Nov..	30·39	29·49	60	26	4·50	9	21		6		3	6	1	8	4	2	
Dec. .	30·35	29·46	55	30	3·64	9	21	1	6	1		2	3	5	8	5	1
Year .	30·52	29·15	84	22	28·94	206	157	3	27	52	29	30	27	80	63	47	11

1833.	*Barometer.*		*Therm.*		*Rain.*	*No. of Days.*			*Winds.*								
	Max.	Min.	Max.	Min.	Inch. and Decm	Fair.	Rain.	Snow.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Vrble.
Jan...	30·62	29·67	46	22	1·40	22	7	2	3	14	8			2	2	2	
Feb. .	30·00	28·88	53	30	5·75	2	26		1	3		3	2	9	9	1	
March	30·30	29·10	57	25	1·01	11	10	10	2	11	4	1	2	4	2	4	1
April .	30·24	28·92	69	33	1·76	9	21		2	1			1	11	11	4	
May. .	30·43	29·36	84	42	0·48	28	3		2	5	1	1	8	9	4		1
June..	30·27	29·39	80	43	4·01	8	22			1	2		6	12	9		
July..	30·38	29·63	81	43	2·26	18	13		1	4		1	1	7	13	4	
Augst.	30·36	29·19	76	42	0·94	27	4		5	2	2			6	11	5	
Sept. .	30·32	29·55	69	35	1·11	13	17		3	5	1		9	3	7	1	1
Oct...	30·23	29·14	67	33	3·12	16	15		1	7	4	5	2	8	2	2	
Nov. .	30·24	29·22	60	27	3·33	12	18			2		3	2	11	9	3	
Dec. .	30·15	29·25	56	29	8·93	3	28						1	14	14	1	1
Year .	30·62	28·88	84	22	34·10	169	184	12	20	55	22	14	34	96	93	27	4

1834.	*Barometer.*		*Therm.*		*Rain.*	*No. of Days.*			*Winds.*								
	Max.	Min.	Max.	Min.	Inch. and Decm.	Fair.	Rain.	Snow.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Vrble.
Jan...	30·30	28·92	56	30	6·30	3	28	None fell during this year.	1		1	4	1	14	9	1	
Feb..	30·42	29·67	56	27	2·19	7	21			2	2	3	4	7	9		1
March	30·49	29·65	60	25	1·19	20	11		1	8	1	2	1	6	11	1	
April .	30·46	29·24	67	29	0·93	24	6		1	16	4	2	1	1		3	2
May. .	30·44	29.38	80	37	0·88	23	8			8		1	5	10	5	1	1
June..	30·33	29·60	84	40	2·79	16	14		1	2		1	4	12	5	3	2
July..	30·23	29·55	84	47	6·26	12	19		2	10			2	10	1	1	5
Augst.	30·15	29·56	84	42	3·65	13	18		4	4		1	4	10	5	1	2
Sept..	30·41	29·42	75	39	1·66	20	10		2	3	7		5	5	5	1	2
Oct...	30·60	29·42	71	32	0·61	21	10		7		2	2		9	5	4	2
Nov. .	30·42	29·27	62	29	2·96	19	11		2	9	5		2	7	4		1
Dec. .	30·58	29·39	58	29	0·88	24	7		6	6	2	2	3	4	5	2	1
Year .	30·60	28·92	84	25	30·30	202	163		27	68	24	18	32	95	64	18	19

1835.	*Barometer.*		*Therm.*		*Rain.*	*No. of Days.*			*Winds.*								
	Max.	Min.	Max.	Min.	Inch. and Decm	Fair.	Rain.	Snow.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Vrble.
Jan...	30·58	28·86	53	16	1·26	20	9	2	4	3	5	2	1	8	6	2	
Feb. .	30·35	29·12	55	25	4.37	5	23		1				1	9	13	4	
March	30·42	28·74	61	28	3·79	13	18		2	8	1		2	7	7	3	1
April .	30·45	29·54	67	27	1·02	18	10	2	6	3			3	6	3	3	6
May. .	30·15	29-43	67	38	2·68	10	21			3			3	11	9		5
June .	30·33	29·26	83	41	1·33	20	10		1	6		2	1	2	7	2	9
July. .	30·07	29·63	82	47	0·94	22	9			4	4	1	2	14	4		2
Augst.	30·20	29·39	84	47	2·95	22	9		4	7	3		3	4	4	3	3
Sept. .	30·05	28·92	75	40	3·68	7	23			1	3	2	6	10	6	1	1
Oct...	30·24	28·89	64	29	5·62	15	16		1	1	5		1	10	9	3	1
Nov. .	30·28	28·89	58	29	4·17	13	17		5	4	2	4	3	7	3	2	
Dec. .	20·43	29·19	55	13	0·72	23	6	2	2	2	9	1	3	8	4	1	1
Year .	30·58	28·74	84	13	32·53	188	171	6	26	42	32	12	29	96	75	24	29

METEOROLOGICAL TABLE,

For the months of OCTOBER, NOVEMBER, *and* DECEMBER, 1835, *kept on Nine-tree Hill, Kingsdown, Bristol.*

Oct.	*Baro.* 9 A. M.	*Thermom.* Max.	Min.	*Pluvio-meter.*	*Wind.*	*Weather.*
1	29·01	61	50	0·43	S.	Fair, A.M. Stormy, P.M.
2	·05	64	37		S. W.	Fine
3	·23	58	47	0·06	N.	Ditto. Rain, P. M.
4	·27	60	41		W.	Fair
5	·56	59	43		W.	Fine
6	·75	61	45	0·05	W.	Changeable
7	·88	58	47		E.	Cloudy
8	·89	60	49	0·32	E.	Fair. Rain, P. M.
9	·30	58	42	0·75	S. W.	Rain
10	28·89	53	39	0·02	N. W.	Changeable
11	29·37	52	39		N. W.	Fine
12	·81	55	47		N. W.	Fair
13	·86	64	45		W.	Ditto
14	30·10	64	53		W.	Ditto
15	·23	64	52		W.	Cloudy
16	·24	62	50		Vrble.	Fair
17	·13	57	47		E.	Cloudy
18	·11	56	37		E.	Ditto
19	·09	58	32		E.	Fine
20	29·75	53	29	0·02	S. W.	Changeable
21	·67	51	37		W.	Fine
22	·37	54	35	0·03	S. W.	Changeable
23	·55	55	38	36	S. W.	Fine, A.M. Rain, P.M.
24	.53	56	42	18	S. W.	Changeable
25	·50	55	40	1·89!	S. W.	Stormy
26	·07	53	38	0·24	S. W.	Rain, A.M. Fine, P.M.
27	·60	49	32		W.	Fine
28	·85	54	39	0·29	W.	Fair. Rain, P. M.
29	·74	57	32	0·05	S. W.	Changeable
30	30·04	51	43	0·90	N. E.	Rain
31	29·75	54	36	0·03	S. W.	Cloudy. Lt.Rain, A.M.

Nov	*Baro.* 9 A. M.	*Thermom.* Max.	Min.	*Pluvio-meter.*	*Wind.*	*Weather.*
1	30·05	45	31		N. W.	Fine
2	·06	49	41	0·79	N.	Rain
3	29·83	54	41	0·57	S. E.	Ditto
4	·84	44	38	0·23	S. E.	Ditto
5	·80	43	31	0·03	E.	Ditto
6	·75	45	37	0·02	N. E.	Cloudy. Lt.Rain, P.M.
7	.86	51	34	0·10	S. E.	Ditto
8	·89	47	36		W.	Fine
9	30·01	43	31		N. E.	Fair
10	·20	40	29		N. E.	Fine
11	·28	41	32		N. E.	Fair
12	·16	41	32		N.	Ditto
13	·27	41	35		N.	Cloudy
14	·07	44	37		N.	Ditto
15	29·99	47	37		N.	Ditto
16	·94	46	43	0·01	N. W.	Ditto. Light Rain
17	·84	52	45		W.	Fair. Aurora Borealis
18	·74	51	38	0·11	S. W.	L.Rn. Aurora Borealis
19	·90	56	40	0·03	W.	Fair. Light Rain, P.M.
20	·87	53	45		S. W.	Fair
21	·78	56	47		S. W.	Ditto
22	·67	58	50	0·45	S. W.	Cloudy. Rain, P. M.
23	·65	55	47	0·03	S.	Cldy. Light Rain, A.M.
24	·62	56	52	0·01	S.	Ditto Ditto
25	·60	57	52		S.	Cloudy
26	·46	58	49	0·34	S. E.	Ditto. Rain P. M.
27	·20	57	41	0·26	S. W.	Fine. Rain at night
28	·28	51	39	0·06	S. W.	Ditto. Light Rain, A.M.
29	·27	53	45	0·74	E.	Much Rain
30	28·89	54	48	0·39	S. W.	Changeable

Dec	*Baro.* 9 A. M.	*Thermom.* Max.	Min.	*Pluvio-meter.*	*Wind.*	*Weather.*
1	29·19	55	41	0·29	S. W.	Fine, A.M. Rain, P.M.
2	·36	50	42	0·02	S. W.	Fine. Rain at night
3	·48	54	38	0·22	S. W.	Changeable
4	·65	52	36	0·08	S. W.	Ditto
5	30·07	49	39		S. W.	Cloudy
6	·01	47	36		S. E.	Fine
7	·02	42	37		N. E.	Hazy
8	29·96	48	38	0·02	W.	Changeable
9	·76	43	23		N.	Fair
10	30·20	33	24		E.	Fine
11	·05	34	22		E.	Ditto
12	·17	39	29		Vrble.	Hazy
13	·19	46	37		S. W.	Cloudy
14	·24	45	40		S.	Ditto
15	·23	44	38		S.	Ditto
16	·23	41	28		S.	Hazy
17	·22	44	34		W.	Ditto
18	·05	47	35		N. W.	Fair
19	29·94	37	29		N.	Ditto. Snow at night
20	·89	33	30		N. E.	Cloudy. Light Snow
21	30·06	32	23		E.	Fair
22	·26	32	17		E.	Fine
23	·43	25	19		E.	Dense Fog
24	·34	27	13!		E.	Ditto
25	·26	25	14		E.	Fair. Fog, P. M.
26	·21	31	23		E.	Hazy. Fine, P. M.
27	·13	42	30		S. W.	Fine
28	29·99	49	33		S. W.	Cloudy
29	30·15	41	36		W.	Ditto
30	·13	47	37		W.	Ditto
31	·18	47	36	0·09	E.	Ditto. Rain at Night

The mode of taking the observations is as follows:—The Barometer (with an open cistern) is noted every morning at nine o'clock, and its height placed opposite to the day of the month; but the Thermometer and Pluviometer, which are also examined at the same time, have their results recorded opposite to the date of the day preceding, consequently they apply to a period of twenty-four hours, beginning at nine, A. M. on the day indicated. The Wind is noted by observations on the highest and best vanes of the churches in the city; and when more than one direction is observed during the day, the word Variable is used. The Weather noted is the general character of the day.

Small Street, Bristol. EDWARD JONES.

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PART II.—LITERATURE.

ESSAY ON THE WRITINGS OF HESIOD,

PRINCIPALLY COMPILED FROM SOME MS. LECTURES DELIVERED AT OXFORD BY THE REV. J. J. CONYBEARE, PROFESSOR OF POETRY.*

Communicated by his brother, the Rev. W. D. Conybeare.

INTRODUCTION ON THE EARLY HISTORY OF GREEK POETRY GENERALLY.

In introducing the classical department of a new journal, It seems desirable to abstain on the one hand from points of more minute and recondite critical enquiry, little interesting to the general scholar; and on the other from subjects so trite and familiar to his most ordinary studies, that in our cursory observations we must altogether despair of at all enlarging the bounds of his previous information. If we would undertake, then, to illustrate the origin and early progress of Greek poetry, Hesiod affords us exactly such a middle station, as on an occasion like the present we should desire.

The great prince and parent of that poetry,

Εξ ὑπερ γενεσις παντεσσι τετυκται,

is a subject far too familiar, to require or admit additional illustration. We may add that our present subject will equally lead us to the elucidation of the very earliest period of Grecian poetry, as far as its remains have descended to us.

* The original is in the purest and most elegant Latin. It will at once be perceived that I have, while availing myself of these stores, necessarily adopted the style which appeared to me best calculated for a popular journal: and it should be added, that a majority of the subjects, of which I have in this introductory essay judged it expedient to enter into a somewhat full exposition, are only very briefly alluded to in the original.

That Hesiod and Homer, indeed, belonged to the same age and school is proved by the genuine and inimitable internal evidence of style, by that hoary down of antiquity, that χνους Αρχαιοπινης, which must be familiar to every one who has been accustomed to investigate the earliest poetical remains of any ancient tribe; whether of the Greek Αοιδοι, the northern Scalds, or the Cambrian bards: for, amidst all the diversities of nations, peoples, and languages, our nature is every where the same; and the first lispings of the muse have every where a strong resemblance. To this internal and unsophisticated evidence, we may add the concurrent voice of tradition; which has ever represented Homer and Hesiod as contemporaries. Herodotus, the father of Grcek history, (Euterpe,) mentions both together; and even gives the precedence to Hesiod, when he assigns both as the great sources of Greek mythology, and places them about 400 years before his own age. The later editions of those traditions, indeed, such as the life of Homer attributed to the same Herodotus, (contradictory as it is to his own genuine account of the date when that poet flourished,) and the celebrated contest of Homer and Hesiod, are universally accounted by every competent critic, to be the clumsy forgeries of some sophist* probably posterior to the age of Hadrian; incorporating however, it may be, some genuine fragments of a proverbial description, which had floated down the stream of oral tradition, from the poetry of this early age.† And sophisticated as these accounts are, still the very foundation on which they are built sufficiently attests the prevalent belief, that Homer and Hesiod were of the same age; and must be allowed to possess some weight in corroboration of the argument already adduced. And the general tendency of this tradition appears to be in favour of ascribing to Hesiod

* This contest is first mentioned by Plutarch, and there are several other authorities in the later grammarians and scholiasts, such as the scholia on Pindar and Eustathius.

† Such as the following:

Ανδρος μεν Στεφανος παιδες· Πυργοι δε Πολησς·
Ιπποι δ'αυ Πεδιϑ κοσμος· Νηες δε θαλασσης·
Χρηματα δ'οικον αεξει· Αταρ γεραροι Βασιληες
Ημενοι ειν Αγορη, κοσμος τ'αλλοισιν ορασϑαι·
Αιϑομεμϑ δε πυρὸς γεραρωτερος οικος ιδεσϑαι,
Ηματι χειμεριω, οποταν νῖφησι Κρονιων.

It is almost impossible for a poetical version to represent faithfully the naked simplicity of the original, which forms its best title to be received as a genuine relic of antiquity; I must therefore eontent myself with plain prose.

Children are the crown of a man, as towers of a town.
Horses are the decoration of the plain, as ships of the sea.
Wealth makes a house flourish; venerable are Kings,
Sitting in the forum, glorious for others to behold.
With a blazing fire the house is more seemly to see,
On the wintry day, when Saturnian Jove sends snow.

the prior antiquity; or, at the very latest, making him contemporary with Homer. The more critically we enquire, we shall find additional reason to assent to their common age, and place it about 900 years before the Christian æra. (See the Excursus of Heyne, at the end of his edition of Homer.) As it has been well argued, that the constant tradition which represents Homer to have been a native of the Ionian colonies, implies that his age must have been subsequent to the Ionic emigration, itself the result of the convulsions which arose in Greece on the re-establishment of the dynasty of the Heraclaidæ, in the Peloponnesus; a similar argument will equally apply to Hesiod, who informs us, with much simplicity, that his father, originally a settler in the Œolian colony of Camœ, had been induced by poverty to return to Greece, and establish himself at Ascra, in Bœotia, at the foot of Helicon, of which place Hesiod himself was a native, although he describes it in no very complimentary terms, as:—

Ασκρη Χειμα κακη, Θερει αργαλεη, ουδε ποτ' εσθλη.

Ascra, bad in winter, terrible in summer, nor ever good.

We may observe, en passant, that both these localities, the paternal residence in an Œolian colony, and the Bœotian abode of the poet himself, would have led us rather to expect a Doric dialect than the pure Ionic which he employs. We must probably suppose, that in this early age the Ionic tribes of Attica spread themselves farther to the north-west, and occupied the Heliconian vale of Ascra, which is in truth not very remote from their subsequent frontier.

Before proceeding to consider, then, the remains of one of these first Coryphæi of the extant poetical literature of Greece, we are naturally invited to premise a few general observations on the early history and condition of this art, as it originally flourished amongst that surprising people, destined almost at once, as it seems, to carry it to a pitch of perfection unsurpassed, if not unrivalled, by any subsequent efforts of human genius; for while, as we have observed, there is a peculiar tone of simplicity, and especially of the absence of every kind of sentimental affectation, which affixes a sufficiently characteristic distinctive mark to the early poetry of Greece, in common with the most ancient minstrelsy of every other language, yet is it strongly distinguished by the advanced state of perfection displayed in the majestic force and dignity of its phraseology, the richness and effect of its characteristic and picturesque compound epithets, and in the finished art and rich and varied harmony of its metrical system, from any thing which we can trace in the poetical progress of other nations; where, as in Nævius and Ennius in Roman literature, and in the rude metrical romances which in our own language preceded our first true poet Chaucer, we find the muse lisping in metre indeed, but in style and language of the most rude and barbarous description. Doubtless, indeed, Greece must have produced many ruder predecessors of the more

gifted bards of Bœotian Ascra and the Ionian Meles; but of these earlier sons of song *etiam periere ruinæ:* as it has not been permitted to observe the Nile as a nascent brook, so our very first view of the flowing stream of Grecian poetry is caught in the full glory of its flood.

We cannot doubt indeed from the nature and necessity of the thing, and the frequent mention in Homer and Hesiod of poets, ΑΟΙΔΟΙ, as a profession flourishing in considerable numbers and high esteem and honour, that the art must already have been cultivated through many previous ages and by a long succession of bards. A list of some seventy such names has indeed floated down the stream of tradition,* but the whole subject is so obscure and mixed with such gross fable, that it were waste of time to pursue it in any detail. We may allow indeed Orpheus to have really flourished as a distinguished poet and legislator, but the remains vulgarly ascribed to him cannot for a moment stand the test of critical examination, and have been clearly demonstrated the supposititious figments of a far later age; nor are we more fortunate with regard to the works of that Linus, whom Hesiod himself appears to have celebrated.

Ὁν δη οσοι βροτοι εισιν αοιδοι και κιθαριστ̃αι
Παντες μεν Θρηνουσιν εν Ειλαπιναις και Εορταις.

"Whom at high feasts—around the social board
Each brother bard and minstrel still deplores."

Still less need we dwell on the idle report concerning the poetesses Daphne and Phantasia,† said to have been the more immediate guides of Homer himself, by writers whom we must regard rather as the compilers of tales than composers of true history.

But although it were thus hopeless to attempt to retrace the previous history of Greek poetry, still it will be very necessary to take a brief survey of the notices preserved to us concerning the state and circumstances of that poetry, as it existed in the age of Homer and Hesiod, which we shall find to throw important light, not only on the condition in which their remains have descended to us, but even on many points connected with the style of their original composition.

The common reader may be perhaps surprised to learn, that it still re-

* See this list in the first chapter of Fabricius Bib. Græc.

† Daphne, an imaginary daughter of Tiresias, is said by Diodorus Siculus, lib. IV. to have resided at Delphi, and to have flourished as a distinguished prophetess and poetess, having furnished many of the materials which Homer appropriated to adorn his own epics; and Photius and Eustathius tell us, that Phantasia, a native of Memphis, composed distinct epics on the very subjects of the Iliad and Odyssey, and deposited them in the Memphian temple of Vulcan, to which Homer obtained access, and pirated copies through the interest of one of the sacred scribes. We must undoubtedly regret, that stern criticism will not allow our gallantry to look to these ladies, as in truth the prime sources whence have descended to us all the gifts of the muses, to whom we so properly assign the same sex, and so to restore to that sex an honour which would thus appear to have been only pirated by the "usurper man."

mains a subject of very doubtful disputation among critics, (unless indeed we are swayed by some very influential names, to concede that it has been determined in the negative) whether the use of alphabetic writing did or did not prevail in Greece at the date of the Homeric poems, there being only one single apparent allusion to such an art in those compositions; and that one will admit, without violence, an explanation referring to mere symbolic representations like those of the Egyptians or Mexicans;* but however this may be, it seems certain that not writing but oral recitation was originally,† and continued even till the age of the Pisistratidæ, the means by which these poems were preserved. The Αοιδοι or bards mentioned in the Iliad and Odyssey, and whose theme is even then said to have been often the "tale of Troy divine,"‡ were in the following age called Ραψωδοι Rhapsodists, which etymologically implies the compilers, or by a more literal translation of an homely metaphor the *stitchers together*, of song; their profession was that of itinerant minstrels, rambling through the towns and villages of Greece, reciting detached portions of epic poetry, whence these *disjecta membra poetæ* were called Ραψωδιαι. The most popular of these recitations appear to have been the Homeric poems; and from this circumstance the reciters were also known under the denomination Homeridæ;§ and Pindar, our earliest extant authority on the whole

* The passage alluded to, is Iliad Z. 169, where Prætus, deceived by the false accusations of his wife against Bellerophon, as having urged her to the very crime in which he had refused to become her associate, dismisses him as an embassage to his kinsman, the king of the Syrians, charging him with private tablets, *inscribed* with matter calculated to procure his death γραψας ενι πινακι πτυκτω θυμοφθορα πολλα. This folded tablet is, in the following lines, called Σημα, a term more descriptive of a symbol.

† This is by no means a modern German theory; Josephus mentions it as the common account (Contra Appionem, lib. I.) και φασιν ουδε τουτον εν γραμμασι την αυτω ποιησιν καταλιπειν αλλα διαμνημονευομενην εκ των Ασματων υστερον συντεθηναι.

‡ Od. VIII. 478.

§ The verb Ὁμηρεω, however, occurs in the Odyssey itself, Π. 468; it is usually explained to meet, but seems rather to be "to speak together with," from ὁμω and ερω, or ερεω: thus Hesiod describes the muses as φωνη ὁμηρευσαι, "reciting with accordant voice."—Theog. 39. This would undoubtedly give us a sufficient etymon for the title Homeridæ; and there have not been wanting critics who have considered it more probable, that the Rhapsodists did not derive their name from the author, but that the author himself was a pure fiction of those who first reduced the scattered Rhapsodies, the works of various bards, into more regular epic form; and coined an appellation for the imaginary single writer of their composite digest, borrowed from that of the Rhapsodists themselves. But when we remember that Pindar speaks repeatedly of the αδνεπης Ὁμηρος as a known poet, and expressly alludes to his poem on the sufferings of Ulysses, Nem. VII. 29; to his recording the bravery of Ajax, Isthm. IV. 63. and (Pyth. IV. 493.) cites a whole line of the Iliad, O. 27.—that Herodotus particularly mentions by name the Iliad and Odyssey as the works of Homer, (critically at the same time rejecting the Cyprian epic also attributed to him) and accurately refers to several particulars as at present contained in these poems—

subject, thus describes them :—Ὁμηρίδαι Ραπτων επεων Αοιδοι.—Nem. II. 1. "The Homeridæ, minstrels of strains compiled." Hipparchus, the son of Pisistratus, is recorded (in a Socratic dialogue, inscribed with his name, and attributed to Plato) to have caused the Rhapsodists of his time to recite these Homeric fragments in their regular order, at the Pan-Athenæa. Cicero, indeed, informs us that Pisistratus himself first caused them to be regularly digested and reduced to writing ; but as this circumstance is unnoticed by Aristotle and every earlier writer, it is not improbably conjectured to be merely a mistaken version of the proceedings of Hipparchus. Hence it has been argued, that it is absurd to believe that the present structure of the Iliad and Odyssey, as two regular epics, bears any more resemblance to their original form as loose and unconnected Rhapsodies, than would take place, if Walter Scott in our day, supplying an Exordium and connecting parts, had wrought up our own detached ballads of Robin Hood and Little John into the unity of an epic system. Our present subject will not require us to enter at length into this controversy ; we will therefore only remark, that it seems scarcely possible to peruse the Odyssey without the impression, that the whole was from its first conception and design, a single and connected tissue of narrative ; and as such indeed it seems referred to by Pindar in the passage cited in the preceding note. In the Iliad, indeed, this regularity of tissue is much more interrupted ; by far the greater part of the poem seems undoubtedly Episodical, and whole Rhapsodies, (or books according to the present digest) are occupied with the αριστεια, or prowess of particular heroes, as if intended to procure the bard himself and his reciters, hospitable lodging in their rambles through the towns where these heroes happened to be the most popular themes of local tradition ; yet undoubtedly, the wrath of Achilles, the woes and defeats which ensued to the Greeks, the humble embassy of his distressed brother chieftains, the sally of his friend Patroclus to the field, his fall, and Achilles' own ultimate return to the war to avenge that fall by the death of Hector, seem sufficiently marked as the prominent cardinal points of the composition as we at present possess it ; although indeed occasionally overlaid by the introduction of much extraneous matter : and we may easily conceive the original bard himself, little aiming at any nicety of artificial composition in that simple age, to have introduced from time to time passages, suggested perhaps under the influences just alluded to, wherever he could most conveniently bring them in. With such views we must sacrifice indeed the injudicious and exaggerated praises of later critics, attributing to Homer an artificial excellence in the construction and management of

and that Aristotle and the whole tribe of succeeding critics of antiquity assume the author and his works as alike undoubted,—we shall scarcely hesitate, I think, to consider the scepticism, for the first time promulgated by their modern German brethren, as rather more ingenious than reasonable. But on all these subjects, I must refer to the Elaborate Excursus of Heyne, at the end of his edition of the Iliad.

his plot, which in truth will be found inconsistent alike with the real form of the poems, and the spirit of the age in which they must have been composed; but this will be all the sacrifice we shall have to make.*

* The Rhapsodists appear to have recited many of the tales of the heroic age—the Ανδρων Ηρωων Θειον γενος, of which the adventures are thus summarily sketched by Hesiod:—

Και τους μεν Πολεμοιτε κακος, και φυλοπις αινη,
Τους μεν εφ επταπυλω Θηβη Καδμηιδι γαιη,
Ωλεσε μαρναμενους Μηλων ενεκ' Οἰδιποδαο·
Τους δε και εν Νηεσσιν υπερ μεγα λαιτμα θαλασσης
Ες Τροιην αγαγων Ἑλενης ενεκ' ηυκομοιο.

Some bitter war and deadly strife consigned
In the Cadmeian plain to hostile graves,
For the contested flocks of Œdipus
By seven-gated Thebes—some led to Troy
O'er the broad wave for fair-hair'd Helen's sake.

Some of these heroic tales were afterwards digested into regular Cycles, beginning, like the Metamorphoses of Ovid, with the creation of the world, and proceeding with a somewhat similar arrangement; these were called the Cyclic poems, and appear to have furnished the subjects for many of the subsequent Greek dramas. The portions relating to the Trojan war, and not included in the Iliad, were modelled into two other poems; one the Κυπρια Επη, "Cyprian Epics," containing the previous events; the other, the Ιλιας Ελασσων, "Lesser Iliad," those subsequent. Both were ascribed, though, as Herodotus shews, without any shadow of justice, to Homer. Aristotle mentions both, as fertile sources whence the drama borrowed. The argument of the former, as recorded by Proclus, is still preserved; it begins with the marriage of Peleus and Thetis. A single fragment from the exordium, is also extant. Mr. Knight thinks that Quintus Smyrnæus may have incorporated some other passages from the lesser Iliad in his own later compilation; he cites as an example the following very beautiful passage, which however, both in sentimental expression and studied grouping, seems far too artificial for this early age. It is a description of a band of warriors, arming for the fight.

Ενθ' αρα τῳ μεν ακοιτις υποτρομεουσα κυδοιμον
Εντε' εποιχομενῳ παρανηνεε δακρυχεουσα.
Τῳ δ' αρα νηπιοι ὑιες, επειγομενοι περι πατρι
Τευχεα παντα φερεσκον. ὁ δε σφισιν αλλοτε μεν πε
Αχνυτ' οδυρομενοις· οτε δ' εμπαλι μειδιαασκεν
Παισιν αγαλλομενος· κραδιη δε ὁι εν δαΐ μαλλον
Ὡρμαινεν πονεεσθαι υπερ τεκεων τε και αυτε.
Αλλῳ δ' αυτε γεραιος επισταμενης παλαμῃσιν
Αμφιτιθει μελεεσσι κακης αλκτηρια χαρμης
Πολλα παρηγορεων φιλον ὑιεα, μηδενι εικειν
Εν πολεμῳ· και ϝερνα τετρυμμενα δεικνυε παιδι
Ταρφεα σημαθ' ἐχοντα παλαιης δηιοτητος.

KNIGHT'S Prolegomena, p. 10, note 1.

"To one, his wife her warrior's weapons bears,
In tears and trembling at the approaching fight;
Another's striplings bustling round their sire
Collect his scatter'd armour—he awhile

It is evident, however, that very material interpolations must naturally have taken place in poems which have descended to us under such circumstances as have attended the earlier fortunes of the productions of Homer and Hesiod; for the history of both is so identified, that we cannot well separate the one from the other, which must be our excuse for having thus far dwelt on the former, who is only thus indirectly connected with our proper subject. The influence which this transmission through the channel of the Rhapsodists has produced on the poems of Hesiod, has been so ably described by the pen of the most philosophical and learned of all the critics who have illustrated any of these compositions, that I cannot better sum up my remarks on this subject, than by translating a paragraph from Wolf's introduction to his observations on the Theogony.

"The Rhapsodists, on whose care the transmission of the older poets depended, being for the most part poets themselves, and having also their memories stored with such an immense variety of the verses of others so often treating of identical or similar subjects, and always pouring forth their effusions under the influence of strong excitement, and with the affectation of a species of divine impulse, it may be well doubted whether such persons were likely to be the most faithful and scrupulous guardians of the compositions thus entrusted to them; and moreover, the style of the original authors had not yet attained that more elegant artifice of structure, in which the general harmony forbids extraneous addition; but rather such was the prevailing simplicity of style and diction, and the whole narrative was so much carried on by disconnected paragraphs and clauses, (omnia ita membratim atque incisim procurrunt) that the greatest facility, whether of interpolation or substraction, was afforded. With these views I can little envy the easy judgment, not to say credulity of those, if there be any such, who can persuade themselves that they read the compositions of Homer and Hesiod, in as genuine and uncorrupted a form, as did the Romans those of Lucretius and Virgil."

We shall find ample illustrations of these remarks as we proceed to examine, in detail, the Hesiodean remains; but we may observe in limine what appear to form the most striking instances of the interpolations in-

> With sorrow marks their grief, but soon again
> Exulting in the promise of his boys
> He fondly smiles; his heart within him burns
> Doubly, for their dear sakes to brave the strife.
> An aged father o'er another bends,
> And girds, with old-experienc'd hand, around
> His son's young limbs, the needful fence of war,
> And much exhorts the youth, amid the press,
> No step to yield for life or death—and bares
> His own old sinewy breast, all seam'd with scars,
> The glorious marks of many a long struck field."

troduced in the manner above stated. In repeated places in the Hesiodean remains, we find entire lines introduced, often verbatim and literatim, identical with, or altered only by the most immaterial variations from, those which we also read in the poems ascribed to Homer.* Critics have sometimes speculated, and with very small success, on these corresponding passages, in order to detect from their comparison some internal evidence, which might enable them to judge which poet was the original and which the imitator, and thus to settle their respective dates. But I think that a judicious examination of the several examples will lead us to agree with Wolf, that in Hesiod they have been generally interpolations, introduced either intentionally or perhaps unconsciously, from the memory of the Rhapsodist, ever overcharged with the materials of his Homeric recitations.

I would conclude these preliminary observations with a short notice of the most striking peculiarities, both of diction and composition, which characterise this early school of poetry; and these observations will be found, I believe, to apply with equal justice both to Homer and to Hesiod.

In the first place, as to the diction; although we have already admitted its general high perfection of force, dignity, and harmony, we shall yet find these blended throughout with many features which sufficiently indicate a period and school of poetical improvisation. The necessities of such a school must always impress a marked character on the poetical language of the period in which it prevails. That language will be ever found very abundant in common-places of constantly recurring epithets and phrases, appropriated to all the most ordinary subjects which may be likely to demand the poet's notice. Every god and hero, and every great feature of nature, will have their inalienable attributes to aid them in filling their just place in the metre. HERE will be ever Βοωπις Ποτνια; and it were impiety to mention Athenè and omit her just style and title as Γλαυκωπις. Achilles can seldom dispense with his characteristic distinction of fleetness of foot, ποδας ωκυς; and Ulysses, when not praised for his many wiles, πολυμητις, is so constantly coupled with the assurance that he was as much enduring as divine, πολοτλας διος, that Pindar gravely comforts us with the hope that not more than half of what Homer tells us is true. Thus also we must usually sail επ' ευρεα νωτα θαλασσης, or walk παρα θιν' Αλος ατρυγετοιο. And in like manner as to phrases; it seems impossible that conversation should be carried on without επεα πτεροεντα προσηυδα on one side, and τον δ' απαμειβομενος προσεφη on the other. And the cause

* Compare Theog. 323, with Il. vi. 181; Theog. 756, with Od. xi. 15; Theog. 749, with Il. xx. 65; Ασπ. Ηρ 156, with Il. xviii. 535; Εργ: και Ημ: 315, with Od. xvii. 347, and Il. xxiv. 44. I have here cited only some of the instances of the incorporation of entire lines; the examples of identity of epithets and phrases are too numerous for notice; but these may have been only part and parcel of the stock of poetical diction common to all the Αοιδοι.

of this is sufficiently obvious. The improvisatore naturally seeks for the same assistance from these prescriptive common-places of established poetical diction, which the tyro, forced, invitâ Minervâ, to his Latin exercise, looks for from the convenient epithets and phrases furnished ready made by his gradus. I think it is quite impossible to read twenty lines of either Homer or Hesiod, without being strongly impressed with the numerous signs which they bear of having thus originally issued from the school of unpremeditated improvisation.

If we turn from the poetical diction, which is but the vehicle, to the general spirit and style of composition, which is the living soul of poetry, we shall find its leading character to be the absence of art and the force of nature. All that is commonly said of the poetry of Shakespeare is far more true of that of the fathers of Greek poetry; for though we do indeed perpetually find in Shakespeare the most simple and affecting touches of genuine nature, we often have our gratification dashed, even at its very highest, by the cold and frigid declamation, not only of art, but of the worst school of art. For the Shakespearian was not like the Homeric age, anterior to rhetoric, but rather anterior to the judgment which might guide how best to use and when it were best to abstain from such aid. But in the early Greek poets we find nothing studied, nothing prepared for effect; we can never suspect artificial trick or design; and therefore the effects, when they do occur, being thus purely the suggestions of unsophisticated nature, are calculated to tell on the soul with double force. Thus in picturesque effect, there is never any studied effort to place a picture before the mind's eye—it occurs merely as the result of picturesque epithets casually employed, or from the simple description of the scenes most familiar to the poet's mind. In moral effect there is no attempt at sentimental display, no laboured contrasts of light and shade; the characters do and say every thing that in simple every-day nature they would have done and said. Can any thing be more affecting than the inimitable scene between Hector and Andromache; but it owes its great charm to its severe simplicity and the obvious absence of artificial sentiment. How had one touch of rhetoric marred that sweetest picture, the infant shrinking with moans to its nurse's bosom, and the father smiling at the mother and removing the terrors of his brazen helmet, with its fearfully nodding crest.

With regard to character also, nothing can be more truly characteristic than the actions and speeches of the individuals introduced in this early poetry; but this also entirely results from the very same reason which we have just alledged, namely, that they do and say exactly what such individuals in their circumstances naturally would have done and said. There is never any artificial attempt to make every word and motion illustrative of some point of character which is intended to be *brought out*. Human beings never do act thus in real life—nor in the earlier Greek poetry. We have only to compare the Ulysses and Ajax of Ovid, with those of Homer, to feel the justice of these remarks.

Yet although this absence of art—this purely natural simplicity, are alone the sources of a thousand beauties, and still more ensure the prevention of the ten thousand vices which result from pedantic affectation, it may yet be justly said, on the other hand, that poetry being itself essentially an art, must, at the same time that it is preserved from these faults, be likewise deprived of some beauties by the infancy of art; and we must own that there will be a want of a just selection of the more prominent and interesting features of the subject; and that in descriptive poetry, more especially, we should look in vain for pictures like those of Virgil, where every word *tells*:—such as,

> "Tum silvis scena coruscis
> Desuper, horrentique atrum nemus imminet umbrâ."

Or that inimitable description of the dove's flight—

> "Fertur in arva volans, plausumque exterrita pennis
> Dat tecto ingentem; *mox aere lapsa quieto*
> *Radit iter liquidum, celeres neque commovet alas.*"

On the whole, I feel I cannot more justly conclude this imperfect attempt to draw a fair estimate of the merits of this early poetry, than by borrowing the words with which Johnson states his impressions with regard to an author, as we have already said, in many respects very similar, Shakespeare, in that most admirable piece of criticism extant in our language, his preface to his edition of that great dramatist:—"Yet it must be at last confessed, that as we owe every thing to *them*, *they* owe something to us; that if much of *their* praise is paid by perception and judgment, much is likewise given by custom and veneration."

ETHNOGRAPHICAL MEMOIR
ON
THE NATIONS OF SLAVONIAN RACE.—Palt I.

The Slavonian race, which has furnished a very considerable part of the population of Europe, including the Russians, Poles, Bohemians, and many tribes extensively spread in the countries to the southward of the Baltic from the Gulph of Dantzig to Holstein, as well as the Servians and other Slavonian people between Hungary and Turkey, was less known to the ancients than either the Celtic or Teutonic race. The early abodes of the Slavi were far removed from the Roman empire: and owing to this circumstance Christianity and literature were long in penetrating to them. As the Slavonians advanced towards the west and south, occupying the countries which had been abandoned by the Goths and other German tribes, and gradually approaching the region of mental culture, they became known to civilized nations. The art of writing was unpractised by the ancient Slavi: it was first communicated to most of them by Christian missionaries, at a

comparatively late period. An opinion indeed long prevailed among the catholic Slavonians of Servia and Dalmatia, that the Slavic letters, termed the Glagolitic alphabet, were invented for their use by St. Jerom. It was pretended that this father of the church, who was a native of Dalmatia, contrived for the use of his countrymen an alphabet, and instituted the Slavonic liturgy. It has likewise been conjectured, that the old pagan Slavi were acquainted from ancient times with the use of Runes. Both of these opinions are groundless: they have been refuted by the ex-jesuit Dobrowsky. As this writer is allowed by all competent judges to be the most profound and accurate investigator of the Slavonic history and antiquities, I shall extract some observations on the origin of writing, and on the conversion of the Slavi, which are contained in his work, entitled "*Geschichte der Böhmischen Sprache und ältern Literatur.*" "Before the fortunate invention of the Slavonic alphabet, az, buki, wiedi, glagol, dobro, &c., says this writer, by the philosophic Constantine, otherwise named Cyrill, the art of writing was entirely unknown to the Slavi." The adoption of Runic letters on the shores of the Baltic does not reach so far back as to allow of the supposition, that the pagan priests at Rhetra and other places, had written the names of their deities with runes, long before the time of Cyrill. On this subject, Dobrowsky refers his readers to the work of Hôfprediger Masch on the Antiquities of the Obotrites; from which I shall make some copious extracts in the concluding part of this paper. "They may, perhaps, first have borrowed these characters from the Danes and Swedes, in the ninth or tenth century. Our Stransky dreamt, indeed, of a Ruthenish, i. e. old Russian mode of writing, supposed to have been used by the old pagan Bohemians; but no other Ruthenian character can have been known before the invention of the Cyrillian, which was termed by some Ruthenian, and by others Bulgarian, because it may be confidently asserted that the Russians first learned to read the Slavonian church-books and letters in the tenth century. The Glagolites in Dalmatia, during the first half of the thirteenth century, pretended that they had their *glagoli*, or letters from their supposed countryman, the celebrated St. Jerom, and therefore termed their *bukvica*, the Hieronymian alphabet; but in the time of St. Jerom, there were *no Slavonian people* on the borders of Pannonia and Dalmatia, or near Stridon, where that illustrious father of the church was born." The pretence of referring this invention to St. Jerom, was an ingenious device of some ecclesiastic in Croatia, who, after Methodius and the old Slavonian formularies, had been condemned as heretical by the synod at Spalatro, in 1068, the people being still attached to their accustomed service, altered, about the end of the twelfth century, the alphabet of Cyrill, and gave it out as an invention of St. Jerom; who, having been born in Dalmatia, was feigned to have constructed it, as well as the liturgy sanctioned by the Latin church. The result was, that in after times, there were two Slavonic alphabets, the Cyrillian and the Glagolitic, or Hierony-

mian, as it was erroneously termed, which was in fact but a mere refacciamento of the Cyrillian."

"But though the Slavonian language was so late reduced to writing, there is no reason for ascribing to it a lower degree of antiquity, than to any other of the mother tongues, as they are called, of the European nations. From external sources, no light has been thrown on its origin, which, like that of other modes of human speech, extends beyond the verge of history. Procopius, who first mentions the Slavi under the name of Σκλαβηνοι could give no further account of their language, than that it was very barbarous—ἀτεχνως βαρβαρος.—By this we are not to understand, as Dobrowsky remarks, that the Slavonic speech was not as regularly formed, as expressive and as harmonious as the Greek, but that it was unintelligible to the writer and his countrymen. The Slavonian language has three terms equivalent to the Greek βαρβαρος: these are Czud, Wlach, Niem. Czud or Tschud are foreign people, but particularly those supposed to be of Finnish extraction; Wlach, which is the Slavonian way of writing the word Welsch, means, as does that term among the Germans, Gauls, and Italians; Niem applies especially to the Teutonic nations. Those who speak dialects intelligible to the Slavi, people of the same word or Slowo, are termed by them *Slovane*. Under this general appellation, since the middle of the sixth century, are included all the Slavonic tribes, the Serbes, the Chrovates, the Leches, and the Tscheches or Bohemians."

The Russian Nestor, continues Dobrowsky, the Bohemian Dalimil, Pulkava, and others, are determined to reckon the Slavonian idiom among the seventy-two principal tongues which some suppose to have originated at the confusion of languages. Pope John VIII., however, when he understood that the Pannonian and Moravian Archbishop Methodius read the mass in a barbarous, that is, a Slavonian language, at first, in the year 879, forbade this practice, but afterwards approved of the invention of the Slavonian alphabet, and appointed the service to be read in the Slavonic speech. "No harm," says this pontiff, in his brief to Duke Swatopulk, "can arise to religion, either* from the practice of singing masses and reading the sacred gospels of the New and Old Testament, well translated and interpreted in the Slavonic language, or by performing the other hourly offices in it; since he who made the eight principal languages, namely, the Hebrew, the Greek, and the Latin, created also all the others to his own honour and glory." Dobrowsky, though a jesuit, animadverts on the unphilosophical expression "to create languages." It is curious to observe this quaint apology which the holy pontiff adopted, for sanctioning, when

* "Nec sanè fidei vel doctrinæ aliquid obstat, sive missas in eâdem Slavonicâ linguâ canere, sive Sacrum Evangelium vel lectiones divinas Novi et Veteris Testamenti bene translatas et interpretatas legere aut alia horarum officia omnia psallere, quoniam qui fecit tres linguas principales, Hebræam scilicet, Græcam, et Latinam, ipse creavit et alias omnes ad laudem et gloriam suam."

he could not well prevent, the circulation of the Scriptures in a language intelligible to the people.

The oldest historians, or chronicle-writers, among the Slavonian tribes are, as we might suppose, from the recent origin of letters among them, of far later date than the English, French, and German historians. Nestor and Dalimil were the authors of the two most celebrated chronicles known among the Slavonic nations. The former of these was a Russian, the latter a Bohemian. Nestor is universally considered as the father of Russian history. The Russians have indeed, like other nations, fabulous legends, which reach up to a period of higher antiquity. According to Bishop Joachim, Slaven, a grand-son of Japhet, built in Russia the city of Slavensk, where a long line of princes reigned before the time of Rurik, the real founder of the Russian monarchy. But these stories are as unworthy of credit as the tales of our Jeffrey. Nestor was a writer of a different class, and almost deserves a place by the side of the venerable Bede. He was an ecclesiastic of the monastery of Petschersky, and died in the year 1056. He was a man of great mental activity, and collected information from all sources on which it was attainable. He consulted the oldest men of Kief, and the best informed persons of various towns in Russia. He collected the oral traditions of earlier times, examined the monuments and tombs of ancient princes, and the registers of the churches. His annals were edited not long ago by the learned Herr Von Schlötzer, the author of some well-known works on the history of the northern nations. The chronicles of Nestor are accounted authentic, but they do not carry back the history of the Russians into periods of any remote antiquity.

Dalimil, the Bohemian chronicler, was much later than Nestor, and a writer of quite different character. His whole chronicle is in Bohemian rhymes, and was a very popular work among his countrymen for two centuries after it was written. It was composed at the monastery of Buntzlaw, and brings down the Bohemian history to the coronation of King John, in 1311, soon after which it was written. The writer was an ardent patriot, full of hatred towards the Germans, whom he regarded as the oppressors of his country; and he magnifies the achievements of every warrior of the genuine Slavic race. The prevalence of Teutonic manners, and the German language, was a common matter of complaint among the Bohemians, and two bad Latin hexameters, by Abbot Peter Von Königral, are cited by Dobrowsky, in which this ascendancy is apparent:—

> "Turba Bohemorum canit hoc, quod scivit eorum
> Lingua, sed ipsorum pars maxima Teutonicorum
> Cantat Teutonicum."

As the historical records of the Slavonic nations, and even the use of letters among the tribes of people belonging to that race, are comparatively of so recent a date, we must look to other quarters for information respecting the early events connected with this people. Some data are found in

the writings of Byzantine and German historians. Notices are also to be collected from the works of the Latin writers of an earlier date, which are thought with probability to relate to the Slavonian tribes : though on this subject there is, as we shall have occasion to remark, some doubt. The first writers who mention the Slavi under terms which afford any correct and undoubted information respecting them, are Procopius, the Byzantine historian ; and Jordanes, otherwise termed Jornandes, Bishop of Ravenna, both of whom lived in the age of the Emperor Justinian. The passages in which these authors speak of the Slavonic nations, and the divisions of their races, are important as historical documents. Jordanes is the most circumstantial, and his account agrees in every respect with the various observations scattered through the Gothic history of Procopius.

Jordanes terms the whole Slavonic race collectively Winidæ, and divides them into two branches, named respectively, Antes and Sclavini.* He informs us that "the vast spaces which lie to the northward of the Carpathian mountains, as far as the sources of the river Vistula, were the abodes of a great and populous nation, termed Winidæ, whose different tribes had many local and particular names, but were principally divided into two branches, the Antes and the Sclavini." In describing separately the countries occupied by the Antes and Sclavini, Jordanes differs from this first statement, or assigns to them at least a greater extent. The Sclavini occupied, as it seems, the territory between the Danube and the Dniester ; for the Civitas Nova of Jordanes is, according to Cluverius, Noviodunum, which was not far from the former river. But beyond the Dniester, towards the north, the Sclavini extended as far as the Vistula, which the historian terms Viscla. To the eastward of these, the Antes, the other branch of the Winidæ possessed the countries adjacent to the Euxine, from the Dniester to the Dnieper or Borysthenes. It appears then, that in the period refered to, the Slavi had in their possession a very extensive region, many parts of which, at least, had been occupied in a former time by nations of different races and affinities.

Jordanes mentions the same tribes, with nearly the same appellations, in another passage. Speaking of the wars carried on by the Goths then inhabiting Dacia, he says, "Post Herulorum cædem idem Hermanricus in Venetos arma commovit, qui, quamvis armis disperiti, sed numerositate pollentes, primo resistere conabantur. Hi, ut ab initio expositionis vel

* His words are as follows :—Introrsus Dacia est ad coronæ speciem Alpibus emunita, juxta quarum sinistrum latus, quod in Aquilonem vergit, et ab ortu Vistulæ fluminis per immensa spatia venit, Winidarum natio populosa consedit, quorum nomina, licet nunc per varias familias et loca mutentur, principaliter tamen Sclavini et Antes nominantur. Sclavini à Civitate Novâ et Sclavino Rumanense et lacu qui appellatur Masianus, usque ad Danastrum et in Boream Viscla tenus commorantur. Hi paludes sylvasque pro civitatibus habent, Antes verò qui sunt eorum fortissimi, qui ad Ponticum mare curvantur, à Danastro extenduntur usque ad Danaprum.

catalogo gentis dicere cœpimus, ab unâ stirpe exorti, tria nunc nomina reddidere; id est Veneti, Antes, Sclavi; qui quamvis nunc ita facientibus peccatis nostris ubique desæviant, tamen tunc omnes Hermanrici imperio serviere: Hæstorum quoque similiter nationem, qui longissimam ripam Oceani Germanici insident, idem ipse prudentiæ virtute subegit." Jordanes in these passages, includes the whole Slavonic race, under the name of Winidæ, which is almost exactly the term given by the Germans in general to all the Slavonic people. Wenden or Wends, and sometimes Winds, is the appellation which is applied to the Slavi by their Teutonic neighbours, as uniformly as that of Welscher was given to the Celtæ, and in later times to the Italians. The appellation of Winidæ is afterwards changed for that of Veneti by Jordanes, who evidently regards the two names as synonymous, or as variations of the same word. Whether the Winidæ, or Wends, were in reality the same people as the Veneti, who are placed by earlier writers in the same region, has been disputed. I shall make some further observations on this subject. Jordanes reckons the Antes and Sclavi, or Sclavini, as sub-divisions of the people, who are termed collectively Winidæ. It may be observed that the Sclavi are placed by him in the north, in a region far removed from the Sclavonians of the Illyrian country. The race of Wends, in the time of Hermanric, seems to have bordered on the Estii, or Esthonians, who possessed the eastern shores of the Baltic.

Procopius describes the same race under a parallel division; he terms the principal tribes Antes and Sclaveni,—Σκλαβῆνοι,—but calls them collectively by a name not elsewhere found, viz. Spori, or Σποροι.* "These nations," he says, "the Sclaveni and the Antæ, are not ruled by one chief, but live of old under a popular government, and therefore their proceedings, both in prosperity and adversity, are referred to common deliberation. All other affairs from ancient usage are conducted in a similar manner among both these barbarous tribes." They dwell in miserable cabins, erected at considerable distances from each other, and not unfrequently change the places of their habitation. When they go to war, most of them march against their enemies with little bucklers and darts in their hands, and without breastplate. Some of them have not even a coat or cloak, and wear no covering but greaves about their thighs, and in this state come to conflict with their opponents. Both tribes have the same language, which is extremely barbarous; nor do they differ in any respect from each other in person: they are all of remarkably good stature and powerful. Their complexions and hair are neither white nor yellow, nor entirely inclined to black, but all of them are somewhat ruddy. They also live like the Massagetæ, in a hardy manner, neglectful of comforts, and like them are always covered with a squalid filthiness. They are by no means cruel

* Spori is probably an erroneous orthography of *Sorbi*, a name common to several tribes of the Slavonian family.

or malicious; but resemble the Huns in their simple habits In ancient times one name was given both to the Antæ and the Sclaveni: they were formerly called in common *Spori,* as I suppose, because they were scattered over the country in cabins separated from each other: owing to this circumstance, they extend themselves over a wide tract of land: most of the territories on one side of the Danube are in their possession."*

Procopius describes the Sclaveni and the Antæ as inhabiting the northern side of the Danube, whence they made frequent incursions into the provinces on the right bank of that river, frequently plundering in their expeditions some of the most populous and fertile countries of the Byzantine empire. It was not until some generations after the time of Procopius, that they gained permanent occupation of these provinces, which their descendants, under the names and divisions of Slavonians, Croats, Servians, Dalmatians, and Bosnians, still continue to inhabit. Of this migration we shall take further notice, after some remarks on the earlier history of the race.

We have seen that Jordanes mentions the Winidæ as inhabiting, in the fifth century of the Christian era, the countries of the upper Vistula, and that he seems to regard them as situated next to the Estii, or Esthonians, a people of Finnish extraction on the Baltic. About three centuries before the age of Jordanes, we find a nation having the same name, or one very nearly resembling it, in the same country, or perhaps a little further towards the north. They are termed by Ptolemy, who lived in the time of Hadrian and Antoninus, Οὐένεδαι, or Wenedæ. The most probable supposition is, that the Wenedæ of Ptolemy were the same people who were afterwards called Winidæ by Jordanes. This opinion has been adopted by some modern writers, while others very confidently affirm, that the Wenedæ of Ptolemy were a German people, who left their country to the eastward of the Vistula, during the movements of the Teutonic nations, and that

* Procop. Hist. Gotth.—This brief outline by Procopius becomes in the version or rather the amplification of Gibbon, a flowing and poetical description. "Four thousand six hundred villages," he says, "were scattered over the provinces of Russia and Poland; and the huts of the barbarians were hastily built of rough timber, in a country deficient both in stone and iron. Erected, or rather concealed in the depths of forests, on the banks of rivers, or the edge of morasses, we may not perhaps without flattery compare them to the architecture of the beaver, which they resembled in a double issue, to the land and water, for the escape of the savage inhabitant, an animal less cleanly, less diligent, and less social than that marvellous quadruped. The fertility of the soil, rather than the labour of the natives, supplied the rustic plenty of the Sclavonians." With the appearance of profound and accurate research, which Gibbon had no necessity of affecting, he informs us that the sum here given as the number of Sclavonian villages, is the result of a particular list in a curious MS. fragment of the year 550, found in the library of Milan, which provoked and exercised the patience of the Count de Buet. Karamsin, the historian of Russia, has taken pains to examine this MS. document, and he has reported it to be full of error, and wholly unworthy of credit. See Gibbon's Decline and Fall, chap. 42. Karamsin's Hist. de la Russie, tom. I. p. 540.

the Slavi who succeeded them obtained the name of Wends, owing to the circumstance of their occupying a country which had belonged to the original, or German Wenedæ. A strong objection to this opinion is the fact, that *Wends,* as we have said, is a very general name for the Slavonic tribes, among their German neighbours. They are called Wends on the coast of the Baltic, and Wends, or Winds, in the provinces lying southward of Hungary. Without entering further into this discussion at present, I shall merely cite the passages in which the earlier Wenedæ are mentioned by Ptolemy, Pliny, and Tacitus.

The first of these writers, in his description of Sarmatia and the nations who inhabited it, has these words : "*κατέχει δὲ τὴν Σαρματίαν ἔθνη μέγιστα, οἵ τε Οὐένεδαι, παρ' ὅλον τὸν Οὐενεδικὸν κόλπον, καὶ ὑπὲρ τὴν Δακίαν Πεύκινοί τε καὶ Βάσταρναι.*" "Great nations inhabit Sarmatia (or the countries beyond the Vistula), the Wenedæ, along the whole coast of the Wenedicgulph, (meaning the Baltic,) and above Dacia, the Peucini, and Bastarnæ." Ptolemy, in another passage, speaks of the Wenedæ as occupying the bank of the Vistula.

Pliny terms a part of the Transvistulan region Finningia, or the country of the Finns, but without defining its extent. In reality, the Finnish race were and are still extensively spread to the southward of the Baltic, and although now subdued by Slavonian nations, were long an independent and distinct people, having a language, religion, and manners, of their own. Pliny says, "Neither is the country of Finningia of less extent than it is supposed to be. Some say that these regions are inhabited up to the Vistula by the Sarmatians, the Venedi, the Scyri, and the Hirri."

The Venedi, or Wenedæ, are more fully described by Tacitus, whose account I must extract, after remarking that this accurate and philosophical writer lay under the disadvantage of believing that there were only two nations in the eastern parts of Europe; and that it was necessary to refer every tribe to one of two divisions, either that of the German or the Sarmatic race. Yet it is certain that neither Finns nor Slavonians belonged to either.

"I am in doubt whether to reckon the Peucini, Venedi, and Fenni among the Germans or the Sarmatæ, although the Peucini, who are by some called Bastarnæ, agree with the Germans in language, apparel, and habitations. All of them live in filth and laziness. The intermarriages of their chiefs with the Sarmatians, have debased them by a mixture of the manners of that people. The Venedi have drawn much from this source: for they overrun, in their predatory excursions, all the woody and mountainous tracts between the Peucini and Fenni. Yet even these are rather to be referred to the Germans, since they build houses, carry shields, and travel with speed on foot: in all which particulars, they totally differ from the Sarmatians, who pass their time in waggons and on horseback. The Fenni live in a state of amazing savageness and squalid poverty. They are destitute of arms, horses, and settled abodes; their food is herbs; their

clothing skins; their bed the ground. Their only dependence is on their arrows, which, for want of iron, are headed with bone; and the chase is the support of the women, as well as the men, who wander with them in the pursuit, and claim a share of the prey. Nor do they provide any other shelter for their infants, from wild beasts and storms, than a covering of branches twisted together. This is the resort of youth—this is the receptacle of old age."

I am much inclined to believe that these Venedi of Tacitus, the Wenedæ of Ptolemy, were in fact the people who were described some time afterwards by Jordanes, as inhabiting the same country; but I must not omit to mention that Dobrowsky is of a contrary opinion. This learned writer supposes that the Slavi were a different people from the old Veneti, or Οὐένεδαι, and that Jordanes, the Gothic historian, gave them the name of Winidæ, owing to his ignorance of this fact. This, however, does not account for the circumstance that the Germans in general gave the name of Wends to people of Slavonian origin.

Whether the Slavonians were the Veneti of Roman historians or not, there will still be some reason for including them among the ancient inhabitants of Europe. Both Von Schlötzer and Dobrowsky have remarked that the Slavonic language has many roots common to it and to the Gothic, a circumstance which evidently denotes an ancient connection of the Slavonians with that northern race. On the other hand, it must be allowed that the Slavonian idioms approximate in many respects to the Asiatic dialects of the Indo-European language. In the frequent use of sibilant and soft palatine letters, and in the forms of words, it bears many striking resemblances to the Sanskrit, and is intermediate between that language and its European correlatives.* Dobrowsky is inclined to the opinion, that the Slavonians inhabited from very early times, the country behind Lettland and Livonia, on the upper Borysthenes, and the upper Volga. Thence they moved to the westward, when the Goths emigrated towards the South of Europe. It was not till that era certainly that the Slavonic race appeared on the great theatre of nations: they had until then never shewed themselves on the western side of the Vistula, or southward of the Carpathian chain. When the Goths, Burgundians, Longobards, Vandals, and other Teutonic tribes, in the north, moved towards the confines of the Roman empire, room was afforded for the progress of the Slavonic tribes, who advanced and occupied the empty space. The eastern division of the race termed Antes, had gained the country on the Danube before the age of Procopius. The western tribes, termed Wends and Obotrites, advanced along the Baltic into Mecklenburg and Holstein: they had occupied on

* For example, the root of the verb to hear, in Greek, κλυ; in Celtic, *clu;* is in the Slavonic, *slu;* in Sanskrit, *sru*. *Quatuor*, four; in Erse, *keathair*, becomes in Russian, *cheture*, in Sanskrit, *chatur*. Many examples might be cited of a similar description.

their way Bohemia and Moravia. Eginhart, the biographer of Charlemain, mentions several Slavonic nations among the people conquered by that celebrated warrior, as the Weletabes, the Sorabes, Abotrites, and Boiohæmi. He says that they differed but little from each other in dialect:—"Linguâ quidem pœnè similes." Dobrowsky enumerates the dialects spoken by all the various nations of the Slavonian race, as follows. To the eastern division, as he says, belong, first, the Russian; second, the old Slavonian, the ecclesiastic or literary dialect of this language; third, the modern Slavonic, or Illyrian dialect, spoken in Bulgaria, Servia, Bosnia, Dalmatia; fourth, the Croatian; fifth, the Windish, spoken by the people termed Winds, in Carinthia, Carniola, Stiria, or Steyermark, together with the variety of the Windish spoken in the county of Eisenberg. To the western branch of Slavonian dialects belong, first, the Slovakian; second, the Bohemian language; third and fourth, the Wendish in Upper and Lower Lusatia; fifth, the Polish, with the Silesian variety of that language.

Dobrowsky distinguishes the dialects belonging to these two classes of Slavonic idioms by certain particles, the use of which is common to a whole class, and unknown to the forms of speech which belong to the other class. I need not specify these, but shall merely remark, that the dialects of the Slavonian language, though numerous and clearly marked, and even constituting groupes severally distinguishable, are yet by no means so remote from each other as are many idioms which are universally regarded as dialects of one language.

The Eastern Branch of the Slavonic Race, including the Russians and Southern Slavonians.

1. Of the Russians.

The Russians, or Muscovites, are one of the nations descended from that branch of the Slavonic race which is termed by Jordanes, Antes, and by Dobrowsky, the eastern division of the Slavi. The Russians are by far the most numerous and extensively spread; and they occupy the regions farthest to the eastward of all the nations belonging to this stock.

The earliest notices that are discovered of the Antes, are in the Gothic history of Jordanes, who mentions the conquest of that division of the Slaves, by Vinitar, the successor of Hermanric, king of the Goths. Vinitar was at that time tributary to the Huns. He subdued the Antes, who inhabited the country lying northward of the Euxine. This tribe was afterwards liberated from the Gothic yoke, by the assistance of the Huns. The following is a brief sketch of the subsequent history of the Russians, as deduced by Von Schlötzer from the Annals of Nestor.

The Russian people consisted in the earliest times of many independent tribes, who are spread over the regions extending northward from the mouths of the Danube. In these countries they were not remotely sepa-

rated from Tschudish, Tartar, and Mongohan tribes, whom they in part drove further towards the north, and in part subjugated; occasionally they were in their turn subdued.

At an earlier period, two principal states arose among the Russians; the northern one near lake Ilmen, about Novgorod; and the southern on the Dnieper, of which Kief was the capital. The former consisted of the principal and most numerous tribes, and the latter of the Little Russians, or the weaker tribes; who, from the level plains which they inhabited, were named Polyænen. The former founded the state of Novgorod, on which occasion they became intermixed with people of Finnish race. Internal quarrels brought the Slavi of Novgorod, the Tshudes and the Krivitsches, near Polocz, about 862, under the dominion of Rurik and his Warjaga Rossi, a Scandinavian tribe, to whom this denomination was given by the Finns. Rurik gave to his new subjects the first laws and the principles of civilization, as far as they were capable of receiving them at that time; and from this period, the inhabitants of the state of Novgorod were termed Russians. Hence we are enabled to explain the fact, that some Byzantine writers, and even Nestor, distinguished the Russians from the Slavi, and the Russian from the Slavonian language. The real Russians were Swedes, and their idioms the Swedish language; which, however, as belonging to the least numerous party, soon gave way to the Slavonian, and was swallowed up in it. Rurik's first successor, Oleg, conquered Kief in 884, and united both states: thenceforward the name of Russians was extended over the southern Slavi, in the country afterwards called the Ukraine. Vladimir, between 980 and 1015, introduced the Christian religion according to the doctrine of the Greek church, founded monasteries, and laid thus the earliest foundations of history and ecclesiastical culture. Kief remained the metropolis of the empire; and although the seat of government was removed to Susdad, and afterwards, in 457, to Vladimir, yet Kief continued to be the centre of whatever learning existed in the country. About 1236, the southern part of the Russian state fell under the dominion of the Mongol Tartars; and about the middle of the fourteenth century, the Poles and the Tartars gained possession of nearly the whole empire, which they held till Ivan Vasilievitsch restored its independence in the last half of the fifteenth century, and laid the foundation of its subsequent greatness. That the early connection with Finns and Swedes, and the adoption of Christianity according to the Greek doctrine in 988, and the long domination of the Mongoles, were not without influence on the Russian language, we have sufficient proof; since among all the Slavonian dialects, the Russian was most corrupted by the introduction of Finnish, Greek, and Tartar words and forms. It is therefore the least understood by tribes belonging to the western branch of the Slavonian race.

2. Of the Southern Tribes belonging to the Eastern Branch of the Slavonian Race.

Besides the Russians and the various tribes of the western Slavonian race, spread through the north of Europe, who will be mentioned in the sequel, there are several nations belonging to the same family, inhabiting the south-eastern part of the continent, or the countries between the Adriatic and the Euxine. The latter are partly subject to the Austrian, and partly to the Ottoman empire. They may be divided into three classes, which are termed severally the Servians, the Croats, and the Winds, or southern Wends. The tribes included in each of these classes are distinguished from those which belong to the other departments by their peculiar dialects, and by other traits. To the Servian branch, according to the evidence afforded by their idioms, belong the Servians, properly so termed, inhabiting the province of Servia, the Bosaians, the Bulgarians, the Uskoks, the Morlachians, the Slavonian people of Wallachia, the people of eastern or Servian Dalmatia, including the republic of Ragusa, and the Servians scattered through Hungary and Siëbenburg.* The second, or Croat branch, includes all the Croat nation, not only the people of Croatia Proper, but some Croat tribes inhabiting districts in Hungary, Dalmatia, and Carniola.† The Winds, or southern Wends, who constitute a third branch springing from this southern division of the Slavonian race, are distinguished likewise by peculiarities of dialect, and by the inveterate hatred which these people and the Croats everywhere bear to each other. The Winds are inhabitants of several provinces in the Austrian dominions, further to the north-west than the former tribes, as Carniola, Carinthia, Steyermark, or Stiria.‡

These tribes are allied by the evidence of their dialects to the Russians, much more nearly than to the Poles or the western Slavonian nations. They are on this ground referred by Adelung and Dobrowsky, to the great eastern division of the Slavic race, anciently termed Antes. The proximity of idiom is such between the Servians and the Russians, that the former people having embraced Christianity about a century before the latter, and having in use the Slavonian alphabet and liturgy framed for them by Cyril and Methodius, these were adopted by the Russians on their conversion and even continue to be used at the present day in the churches of Russia, having undergone but slight alterations.§ By Nestor, the old ecclesiastical Russian dialect is termed Servian; and both the Russians and the Servians make use, according to Adelung, of the same bible and other religious books, and understand each other in conversation better than the individuals of any other two Slavonian tribes.

* Adelung, Mithrid, th. 2. p. 639. † Adelung, p. 647. Dobrowsky, p. 32.
‡ Adelung, p. 654. Dobrowsky, p. 32. § Adelung, p. 621.

Respecting the history of the southern Slavonic tribes, different opinions have been maintained; but this has not arisen from the want of data, on which a tolerably certain conclusion might be established. Some writers have imagined, that the Slavonian nations in the countries between the Adriatic and the Euxine, were the primitive inhabitants of that region. "Dolci, a native of Dalmatia, identified the Slavonians with the old Illyrians, and Katansich supposed the dialect of the Croats to be the old Pannonian language, on no other grounds than some forced etymologies of ancient Illyrian names from the Slavonic." The Veneti, on the Adriatic Gulf, have been supposed from their names to have been Wends or Slavonians; and the Ragusan Count Sorgo even attempted to trace the names of the Greek and Roman gods from the same language.* All these conjectures are founded, according to Dobrowsky, on ignorance of the historical fact, that the Slavonian tribes now inhabiting the country near the Danube and the Adriatic, first came into this region in the sixth century of our era.

The migration of the Servians is recorded in an obscure passage of the Emperor Constantine, in his work "De Administrando Imperio," which has been cited and illustrated by Adelung. The following is a translation of it :—

"It must be understood that the Servians, (meaning the Servians of Dalmatia and Illyricum) are descended from the pagan Servii, also called White Servians, who inhabit the further parts of Turcia, (that is, Hungary) in a place called by them Boici, on which Francia (viz. the empire of the Franks, at that time including Bohemia) borders, as likewise does Great Chrobatia or Croatia, still pagan, which is also called White Chrobatia. In that country, therefore, was the original abode of these Servians."

The White Servia, or rather the Great Servia, whence the Servians to the southward of the Danube are here said to have migrated, is shewn by Adelung to have been Little or Red Russia, on the Upper Vistula, and the modern East Gallicia. The Magna Chrobatia, whence the Croats proceeded, was also to the northward of Hungary, near the Carputhian Chain. The movements of the Slavonian tribes towards the south, appear to have been gradual, and as circumstances opened to them a way. Pannonia, or Hungary, was left vacant in the sixth century, in consequence of the migration of the Longobards into Italy. It fell into the possession of the Avars; and on this occasion, Slavonic tribes, who were their allies or vassals, were settled in Carinthia, and Carniola, in the year 568.† Already, in the age of Procopius, the northern bank of the Danube was in the possession of Slavonians of the race of Antes. These barbarians, in their annual expedition into the provinces subject to Justinian, wasted the country of its former inhabitants, and the wilderness was peopled by hordes of their own kindred. In the first half of the seventh century,

* Dobrowsky, Geschichte, p. 7.

† Dobrowsky, p. 7.

under the Emperor Heraclius, Slavonian tribes obtained possession of Servia and Dalmatia. About the same time, several clans arrived in Bulgaria, to whom the Bulgarians, as conquerors of the country, assigned lands in 679. The colonies of this people extended from the Euxine to the Adriatic. The Croats became a powerful nation, and were ruled by sovereigns of their own: they had possession of nearly all the eastern coast of the Adriatic, and exercised piracy for many years in that sea, and in the Mediterranean.

Of the Western Branch of the Slavonian Race.

To the western division of the Slaves, belong the Bohemians, the Poles, the Sorabians, and the northern Wends. Each of these four nations is subdivided into tribes differing more or less from each other in dialect.

I have observed that all the eastern Slavonians, including the Russians, as well as the detached tribes who passed from the main body of the nation across the Krapak, and settled alternately to the southward of the Danube, derived the rudiments of literature, and the light of Christianity and of civilization, from instructors of the Greek church. The western Slaves, on the other hand, are wholly indebted to the church of Rome for these inestimable blessings; and their scribes adopted the Latin alphabet, so modified, that it might be rendered serviceable to people who used the Slavonian speech.

1. The Bohemians.

The language of the Bohemians has been the most cultivated among all these dialects. Christianity was introduced among the Bohemians during the latter part of the ninth century, and doubtless with it the knowledge of letters. The oldest specimen, however, that is extant of the Bohemian language, is a short hymn of Bishop Adalbert; which, somewhat modified, is still sung in some of the churches of Bohemia: it is given by Dobrowsky, in the work already cited. The earliest Bohemian chronicler was Dalemil, who wrote his chronicle in rhyme, about 1310. In the same century, the first Bohemian version was made, of which a copy in a parchment manuscript is preserved in the Royal Library of Dresden. From that time the culture of the Bohemian language and manners improved after German models, and attained the highest pitch under Rudolph II. The interval between 1577 and 1610, was the Augustan age of Bohemia. The literature, together with the national spirit of the people, fell into decay at the close of that period, and became almost extinct during the thirty-years' war. The Bohemians were termed by other Slaves, Tschech or Chechi, which, according to Dobrowsky, means *the Foremost*, describing, apparently, the local position of this tribe in relation to the great body of the nation. Bohemia, as it is well known, is the name, not of the people, but of the country, which obtained this term when

inhabited by the Celtic Boii, who were succeeded by the German Marcomanni, as were the latter by the Slavonians. The Slavonians occupied Bohemia about the middle of the sixth century, after the destruction of the Thuringian kingdom, in which Bohemia was probably included.

The Moravians are nearly akin to the Tschechi, or Bohemians. Their dialects are said to be merely varieties of the Bohemian language. The Moravians take their name from the river Morava; they give to their idiom the term of Morawsky gazyk, and decline that of Czechy gazyk, or the Bohemian speech.

The Slavonian inhabitants of Moravia are in three divisions, and have three dialects. The first, or Hannaks, taking their name from the river Hanna, are the agricultural peasantry of the province. The Wallachii are pastoral people of the boundary between Moravia and Hungary. The Slovaks, or Slavaks, are the Slavonian people who inhabit the eastern frontier of Moravia, and some of the upper districts of Hungary.

2. The Poles.

The proper national appellation of the Poles, is *Lechs* or *Lechi:* the name of Poles was originally that of a single tribe. The history of the Poles is more enveloped in fable and obscurity than that of any other Slavonian people, because they were the latest in obtaining national writers. The Slavonic tribes who form the Polish nation, probably occupied their country on the departure of the Goths towards the south. They formerly extended over Silesia, in several districts of which the Polish language is still spoken. Among the popular dialects of the Polish language, Adelung distinguishes that of the Masurians, the descendants of a particular tribe, and the idiom of the Kassubians in Pomerania, Lunenburg and West Prussia. The Poles were converted to Christianity, and adopted the forms of the Latin church in the year 965. The ecclesiastics made use of the Latin language for all purposes of religion and literary composition, and the Polish language remained little known and unimproved; it was long regarded as the speech of the vulgar and uncivilized.

3. The Sorabians.

The Sorabians, or the Serbi, as, according to Adelung, they are properly termed, are a numerous people of the western Slavonian race, who formerly inhabited the country between the Saale and the Oder, and of whom the Slavi in both the Lusatias are the remains. The Slaves in Lower Lusatia call themselves *Sserske,* those of Upper Lusatia *Srbie.* The country which these Sorabians occupy, was inhabited before them by the *Hermundurians,* or Thuringians. On the destruction of the Thuringian power by the Franks and Saxons in 528, the Sorabians came in and reduced the German inhabitants to slavery. They had some chiefs, and even kings of their own. They possessed the present Osterland, Meissen, both the Lusatias, the territory of Anhalt, the Electoral Circle, and the

southern part of the mark of Brandenburg. The Germans have ever termed them Wends.

After this conquest, and the division of their territory in the tenth century, they became much intermixed with German colonists, particularly in the woody and mountainous districts, which the indolent Slavonians had left uncultivated. It thus happened, that in Osterland and the Ertzgebirge, more villages are found with German than with Slavonian names. Yet the original language maintained its ground, for a considerable time, in the district inhabited by Sorabians or Wends, until about the fourteenth century, when its use in courts of justice was forbidden, and it became wholly lost, with the exception of some words which are preserved here and there. In the two Lusatias, however, owing to the long connection between these districts and Bohemia, the old tongue is still preserved. Also in Meissen, near the frontier of Upper Lusatia, there are many villages inhabited by Wends. Lusitzi, whence the name Lusatia, means, in the Slavonic, a low swampy land.

The Lusatian or Wendish language, as it is termed, is still a living idiom, and spoken, especially in Upper Lusatia, by great numbers. It is a written language, and a variety of German books have been translated into it.

4. The Northern Wends.

The northern Wends are in some respects a more interesting people than the preceding branch of the Slavish race. Their history presents in early periods, more numerous points of relation to that of the Germans, than are to be found in the annals of any other tribe of the same family.

The Wends formerly possessed the whole northern maritime region of Germany, with the sea coast from Holstein to Kassubon. They were divided into a number of tribes; the principal divisions being the Obotrites in the west, and the Wiltzes, or Luititzians, towards the east. Both these nations have long ceased to exist as separate races. The last person who spoke the Wendish in Pomerania, died in 1404. In some districts of Lunenburg, remains of the Obotrites were preserved till a late period. These people were the Linones, named from the river Leyne. The tribe termed Polabes, from Labe, the Elbe, and the Slavonian preposition *po, on,* who lived near Ratzeburg, was extinct much more early; and the Linones are commonly termed, though improperly, by their name.

The Slavonians of northern Germany formed, during many ages, powerful and independent states; and their numbers were so great, as to bear a considerable proportion to those of the native, or Teutonic inhabitants. The history of the Obotrites, and other tribes of the same family, holds a conspicuous place in the annals of the middle ages. The southern shore of the Baltic was long almost entirely in their possession. Hamburg belonged to the Obotrites; and Wineta, at the mouth of the Oder, was a city of great extent and wealth, and the principal emporium of

* Mithridates, th. 2.

the Baltic trade, long before the era, at which the history of the North opens itself to our survey. Ruins of marble and alabaster mark the spot where Vineta sank into the sea. Julin, which succeeded to its opulence, rejected Christianity. "Suddenly," says Von Müller, "lightning set fire to its wooden streets, and the whole city was consumed. The Obotrites, in Mecklenburg, likewise adhered for a long time to paganism; and they several times relapsed into idolatry, after giving encouragement to missionaries, and displaying the outward appearances of compliance with their efforts. Charlemain prevailed upon them to receive instruction in the religion of the civilized world, and defended them against the Saxon Wittikind, whose hostility was provoked by their acquiescence. But when the influence and predominant power of the Carlovingian princes was withdrawn, paganism resumed its sway; and nearly three centuries afterwards, we find it not completely rooted out on the shores of the Baltic. Such was the obstinacy with which the Wends adhered to their ancient superstition, that the arms of the Teutonic knights were for a long period vainly employed in the attempt to exterminate their idolatry. The ancient customs of the Slavi, together with their national independence, were preserved to a later period in Mecklenburg, than in any other part of Germany; and it is said, that that country derives its present name, Mecklenburg, from the Mickli, an order of priests among the idolatrous Wends.

It has been a question at what period the Slavonian nations obtained a footing in Germany, in which they appear to have spread themselves over so many extensive regions, either subjugating, or entirely rooting out, the original inhabitants. Schlötzer, who has enumerated thirty-three Slavonian tribes or nations, in different parts of Germany, supposed that many of them may have been settled there from ancient times. Most modern writers have been of a contrary sentiment; and among the old historians, we find no ground for Schlötzer's opinion. On the contrary, all the ancient writers speak of the Vistula as the boundary of Germany and Sarmatia, and place the Venedæ, and the other nations foreign to the Teutonic race, to the eastward of that river. It was, in all likelihood, subsequently to the southward movements of the tribes of northern Germany, that the Wends crossed the Vistula, and occupied the countries which had belonged to the Suevi and other Teutonic nations. In the territory of the Vandals, they succeeded to the very name of that people. The Wends of the middle ages were called Vandals; and the kings of Denmark, who made conquests in that country, assumed the title of sovereigns of Vandalia. With respect to the periods at which the different Slavonian tribes gained possession of the German provinces, we may receive the opinion of Gatterer as the most probable. This writer supposes that they established themselves in Bohemia, Moravia, Saxony, and Thuringia, in 534; and in Stiria and Pomerania, between the years 569 and 588.

The most authentic sources of the history of the Obotrites and other Slavonic tribes in Mecklenburg, and the German provinces on the Baltic, is to be found in the Chronica Slavorum, or Slavonian Chronicle of Helmoldus, which was published from MS. by Henry Bangert, at Lubeck, in 1559. The editor informs us that Helmoldus lived in Wagria, which was that part of Holstein bordering on the Baltic. He had a temple and *a domuncula* in Bosow, and laboured in the conversion of the Wagrians, who were pagan Slavonians. Helmoldus died, A. D. 1170. "Nobody before Helmoldus," says Bangert, "wrote fully on the history of the Slavi."

Helmoldus, in his description, says "that the Baltic is so called, because it extends, like a belt, through the Scythian regions as far as Greece—meaning, says Bangert, Russia." "The Dani and Sueones, termed Northmanni, inhabit the northern side of this sea. On the south of it are Slavonian nations; first, towards the east, are the Ruzi; then the Poloni, leaving the Pruzi to the north, aud the Bojohæmi to the south, as also the Moravi and the Sorabi." The Pruzi are probably the Prussians; but Helmoldus was quite mistaken in supposing these to be Slavonians. He says "that the Pruzi had not yet received in his time the light of Christianity; they use," he adds, "the milk and the blood of their cattle for drink, 'ut inebriari dicantur.'" To the westward of the Poles, Helmoldus places the Winali or Wends. The first of their provinces, from the eastward, is Pomerania*—reaching to the Oder, at the north of which was Vineta, the greatest and most celebrated city in all Europe, which was destroyed by the Danes, while the people obstinately adhered to pagan idolatry. Beyond the Odora, that is on the western side of it, several other Wendish states are enumerated by Helmoldus as the Tholentzi or Redarii, on the lake of Tollentz. Of these people and their idolatrous worship at Rhetra, I shall have occasion to say more when I come to the history of the Slavonian Mythology. The Obotrites in Mecklenburg were another tribe. Their country, as Bangert shews, has three times changed its owners. It first belonged to the Vandals, a German nation; then to the Slavonian Obotrites, who were conquered and partly expelled by Henry the Lion, duke of Saxony, the great founder of the Guelphic family.

We have thus traced the progress of the Slavonic nations, in one direction towards the south, and in another towards the north-west. We have seen that tribes of the eastern division of the Slavic race, termed by Procopius and Jordanes, Antes, issuing from their original country or from the region where they had dwelt from immemorial time to the northward of the Krapak about the sources of the Vistula, passed that barrier into Pannonia or Hungary soon after it had been deserted by the Goths, who were migrating into Greece and Italy. From Pannonia, where they occupied the northern shore of the Danube, they long molested, by their

* The name of Pomerania is from Slavic words *Po*, on, and *Mer*, sea.

predatory incursions, the Byzantine empire; and at length gained permanent possession of the provinces, which, to the southward of the Danube, stretch across the continent from the Adriatic to the Euxine. Under the various names of Servians, Dalmatians, Croats, Wallachians, Bosnians, and Bulgarians, the same people still form the mass of population in those countries, where their language testifies their origin. Tribes of the other, or western branch of the Slavonian stock, appear to have crossed the Vistula into northern Germany, at different times in the sixth century, and to have spread themselves over the territories, wholly or partly abandoned by the Suevi, the Vandals, Burgundians, and other Teutonic nations, over Bohemia, evacuated by the Marcomanni, and over all the southern sea-coast of the Baltic. Notwithstanding the numbers and the extent of the countries occupied by the Wendish tribes, the greater talents and military power of the Saxons, Danes, and other German nations, at length overcame them. They adhered with the tenacity of ignorant idolaters to their dark and barbarous superstitions, but at length admitted the prevailing light of Christianity, the progress of which has ever held an even pace with the social improvements of mankind. Still many dialects of the Slavonian language form the vernacular speech of numerous tribes to the westward of the Vistula, and within the boundaries of ancient Germany.

We shall in the sequel endeavour to form some idea of the Slavonian nations in a different point of view, and obtain some insight into their mental character, and the nature of those superstitions to which they were so obstinately attached.

REVIEW.

Select Remains of Rev. C. F. Ramftler, Minister in the Church of the Moravian Brethren. By the Rev. T. Grinfield, M. A. 8*vo. pp.* 288. Bristol, Chilcott, 1833.

This is a plain and unpretending little volume, which commemorates an individual well known and respected in this city, and which has been, both from local circumstances and its intrinsic merits, widely circulated therein.

Christian Frederick Ramftler was a minister in the church of the United Brethren or Moravians, after the Waldenses, the most ancient Protestant community, and one of the most respectable. He was born and educated in Germany, whither his parents and grand-parents had been driven by those religious persecutions, whereby France, to her own material injury, bestowed upon other countries inestimable benefits, in arts, policy, and religion, and in the persons of many valuable citizens.

In the year 1801, at the age of twenty-five, Mr. Ramftler proceeded to England, to take charge of a congregation; and in 1824 he settled upon a similar appointment at Bristol, where he died in 1832, aged fifty-two.

The volume before us contains a Memoir of Mr. R., several of his Ser-

mons, and selections from his personal Diary. The Memoir is that of an upright and energetic minister of religion, discharging the duties of his office with fidelity and zeal, esteemed and trusted by the people under his ministry, and by his clerical brethren of all denominations; and sacrificing all minor, that is all considerations, to the principal object of his profession. Mr. Grinfield has acted the part of a faithful and judicious biographer, in laying before his readers the infirmities as well as the excellencies of this most elevated character, and it is to be wished that this example were more generally followed on such occasions. The world are well enough aware that no man is perfect, and if no imperfection be acknowledged in the history of an individual, very naturally and very justly doubt of its complete credibility. We feel great pleasure in recommending this little volume to our readers.

Picturesque Antiquities of Bristol. By J. S. Prout. Nos. I. and II. G. Davey, Bristol.

These are illustrations of the ancient and picturesque parts of the city of Bristol, some of the most striking of which, from the dirty and inaccessible quarters in which they are found, are not likely to be presented to the view of many of our readers in any other manner.

In the numbers before us, Mr. P. has wisely confined himself chiefly to delineations of the domestic architecture of the city, and more especially to those gradations of style which followed the decline of regular Gothic architecture in this country; and which, from their irregular plan, and the heterogenousness and instability of their materials, are usually to be found in that stage of decay which is said to be most favourable to the picturesque. Of these the "Fourteen Stars," (plate 6,)—of which, to judge from its ricketty aspect, the drawing before us is likely soon to be only the memento—and the "Castle Bank," (p. 10.) the timbers of which are said to have been carved in Holland—are very good examples.

In the crypt of St. John's church also, the peculiar features of the building are well and correctly marked.

Mr. P. in these drawings has paid considerable attention to architectural principles and features, the observation of which can alone make such delineations instructive as well as amusing. The artists of the last century, with one or two exceptions, threw scarcely any of the typical features of a building into their sketches, and this was even the case with Grose and others, regular architectural artists and antiquaries.

The subjects which Mr. P. has chosen seem admirably suited to his style, which resembles in many points that of his distinguished namesake and, we believe, relative. It is to be wished, however, if practicable, that some slight description should be appended to the views of such of the buildings as deserve it; giving some little information concerning their date and interior ornaments, or any particulars worth mentioning in their history.

Palatial and Parliamentary Edifices of Westminster. By J. Britton and E. W. Brayley. No. 1, pp. 32. January, 1835.

This is the first number of a history of the regal and parliamentary edifices of Westminster, prepared by two of the most indefatigable of our antiquaries, Messrs. Britton and Brayley, who have taken advantage of the interest excited by the late great conflagration, to bring out the present work. This number commences with the early history of Westminster, in Saxon times, proving the existence of a palace there from a very remote period, and carrying that history down to the reign of Henry III. in 1223.

Westminster possesses a threefold source of interest to the loyal, the constitutional, and the christian subject, in the remains of its palace, in its parliamentary edifices, and in its magnificent and venerable cathedral. It does not appear that any part of the existing structures is more ancient than the end of the tenth or commencement of the eleventh century, though such may possibly be the case. The Hall is known to have been erected by Rufus, as the part of a yet larger building. The Chapel of St. Stephen, better known to Englishmen as the Chamber of their Commons, is attributed originally to the monarch of that name; and the greater part of the Abbey Church, as its history and the style of its architecture plainly evince, was the work of Henry III.

Appended to this number are four engravings, the first, or frontispiece, composed of various portions from St. Stephen's chapel and cloister, in the latest or perpendicular gothic. The second, marked plate VIII., we suppose with reference to a future and descriptive part of the work, represents a compartment of the east side of Westminster Hall, near the south end. Here we distinguish part of the original wall of the building, and a small Norman arch, probably coeval with it; a cornice, corbels, and springers, of the reign of Richard II., whose armorial bearings, with those of the Confessor, are seen, together with the devices of the former monarch. Two windows are visible, apparently of the same date, but filled by tracery which has been interpolated at a much later period. The lights are blocked up by modern brick-work, and the tracery, which presents nothing very remarkable, is broken and defaced.

The third plate, marked XV. represents the interior of the painted chamber, as seen after the fire; and the fourth (XXX.) gives the upper cloister and part of the chapel of St. Stephen, presenting a great variety of arches—late perpendicular work—mixed up however with parts of far higher antiquity.

The number altogether reflects credit upon its authors, and the permanent value of the work is enhanced by the number and correctness of the references to authorities. We shall reserve our further remarks until a larger portion of the entire work has appeared.

DOMESTIC OCCURRENCES, &c.

SINGULAR INQUEST.

The relations of a woman named Smith, having heard nothing of her for upwards of a year, were induced to make enquiries respecting her in Bristol, whither she had gone to reside. Finding that she had died suddenly upwards of twelve months before, and that the persons at whose house she had lodged could give no satisfactory account of her death, nor of the property of which she was known to have been possessed, a suspicion arose, strengthened by the character of the parties, that she had been unfairly dealt with. Under these circumstances, the disinterment of the body was determined upon. This was accordingly done; the body was opened, the intestinal viscera taken out, their condition examined, and a portion of their contents analyzed. In consequence of the discovery of arsenic in the stomach, the investigation proceeded. The purchase of arsenic by the accused, the persons by whom it might have been obtained for her, the druggist from whom it was bought, were next inquired into. Then the circumstances preceding the deceased's illness, the nature of her food and medicine, the hand from which she received it, and the servants who waited upon her, were ascertained: and finally, the amount of the deceased's property, the circumstances of the accused before and after the death, and the inducements to commit, and increase of wealth, &c. likely to follow such a murder, were taken into consideration.

The enquiry therefore related to the establishment of four points.—1. The identification of the body. 2. The cause of its death. 3. (Assuming it to have been by poison,) the person administering the poison. 4. Whether the poison was wilfully administered.

The first point was proved by the undertaker who supplied the coffin—by the carpenter who screwed it down—by the sexton, who can tell from appearances that the grave has never been disturbed—by the nephew of the deceased, and by two of her fellow-lodgers, who speak to the height of her figure, colour of her hair, and marks upon her stockings.

The second point was also proved, by the evidence of Dr. Riley and Dr. Symonds, physicians, and by Mr. Kelson, surgeon, who recognize effects upon the viscera, which might have been produced by arsenic—by Mr. Herapath, who analyzed a small portion of the contents of the stomach, and discovered five grains of sulphuret of arsenic—and again, by the medical men, who stated the quantity present to be sufficient to cause death.

To establish the third point, it was proved that an individual had bought sulphuret of arsenic of a druggist who was in evidence, and that Mrs. Wade, the lodging-house keeper, alone administered food to the deceased. This third point was not proved; the arsenic not having been traced from the druggist's shop into Mrs. Wade's hands.

Upon the last point it was shewn—that Mrs. Wade had cautioned the servant not to taste food after the deceased—that she was singularly anxious, against her apparent interest, to detain the deceased in her lodgings—that the deceased had reeeived £800 a year before her death—that the Wades beeame suddenly rich after that event—and that therefore there were inducements to commit, and appearances likely to follow the commission of such a murder.

Upon these considerations, which were very clearly stated by the coroner, the jury returned a verdict of "*Wilful Murder*" against Mrs. Burdoek, formerly Wade, who is accordingly in custody, for trial at the ensuing assizes. Under these circumstances, we think it just to withhold any regular report of the proceedings, until after the trial has taken place.

MONUMENT TO BISHOP BUTLER.

Bishop Butler, the author of the "Analogy of Religion," after presiding over the see of Bristol during a period of twelve years, was translated, in 1750, to that of Durham. His health failing, he again resorted to Bristol for the benefit of its waters; and finally, dying at Bath, June 16, 1752, his body was interred in the ehoir of the cathedral of Bristol.

Upon the plain horizontal slab which covers his remains, is the following inscription, attributed to the pen of his chaplain, Dr. Nathaniel Forster.

H. S.
Reverendus admodum in Christo Pater
JOSEPHUS BUTLER, LL.D.
Hujusce primo Diœceseos
Deinde Dunelmensis Episcopus.
Qualis quantusq: Vir erat
Sua libentissimè agnovit ætas:
Et si quid Præsuli aut Scriptori ad famam valent
Mens altissima,
Ingenii perspicacis et subacti vis,
Animusq: pius, simplex, candidus, liberalis,
Mortui haud facile evanescet memoria.
Obiit Bathoniæ, 16 Kalend. Julii,
A. D. 1752.
Annos natus 60.

The writings of this great and good man are a monument far more durable than either brass or marble can supply; it was not therefore to do honour to the memory of Bishop Butler, but to the See and City of Bristol, that a subseription was raised during the last year, for the purpose of erecting in the cathedral some appropriate evidence of their respect.

The plan was set on foot, and a sum of upwards of £130 raised, chiefly by the exertions of Mr. C. B. Fripp, to whom therefore many of the admirers of Bishop Butler will feel themselves to be indebted.

Mr. Southey supplied the inscription, a noble testimony of his power as an author, as well as of his regard for his native city; and the design was presented by Mr. S. C. Fripp, who also, we believe, superintended its erection.

SACRED
TO THE MEMORY
OF
JOSEPH BUTLER, D.C.L.
TWELVE YEARS BISHOP OF THIS DIOCESE,
AND
AFTERWARDS BISHOP OF DURHAM,
WHOSE MORTAL PART IS DEPOSITED
IN THE CHOIR OF THIS CATHEDRAL.

OTHERS HAD ESTABLISHED
THE HISTORICAL AND PROPHETICAL GROUNDS
OF THE CHRISTIAN RELIGION,
AND
THAT SURE TESTIMONY OF ITS TRUTH
WHICH IS FOUNDED IN ITS PERFECT ADAPTATION
TO THE HEART OF MAN.
IT WAS RESERVED FOR HIM TO DEVELOPE
ITS ANALOGY TO THE CONSTITUTION
AND COURSE OF NATURE;
AND LAYING HIS STRONG FOUNDATIONS
IN THE DEPTH OF THAT GREAT ARGUMENT,
THERE TO CONSTRUCT
ANOTHER AND IRREFRAGABLE PROOF;
THUS RENDERING PHILOSOPHY
SUBSERVIENT TO FAITH,
AND FINDING, IN OUTWARD AND VISIBLE THINGS,
THE TYPE AND EVIDENCE
OF THOSE WITHIN THE VEIL.

BORN A. D. 1692, DIED 1752.

"HE WHO BELIEVES THE SCRIPTURES TO HAVE PROCEEDED FROM HIM WHO IS THE AUTHOR OF NATURE, MAY WELL EXPECT TO FIND THE SAME SORT OF DIFFICULTIES IN IT AS ARE FOUND IN THE CONSTITUTION OF NATURE."

ORIGEN, *Philocal.* p. 23.

ERECTED BY SUBSCRIPTION, A. D. MDCCCXXXIV.

The monument is about thirteen feet in height, by eight broad, and occupies the side entrance (blocked up for the purpose) to the Newton chapel, in the north transept of the cathedral. In style it is perpendicular gothic, harmonizing well with the building. It consists of three divisions, each subdivided by an embattled transom into two compartments; in the upper central compartment, upon a pannel of white marble, is Dr. Southey's inscription, and below the quotation from Origen.

In the lateral compartments are escutcheons; that on the right charged with the paternal coat of Butler, argent, three covered cups in bend between

two cotises invected or, impaled by the arms of the bishopric of Bristol, sable, three ducal coronets in pale or; that on the left charged with Butler, as above, impaled by the arms of the bishoprick of Durham, azure a cross between four lions rampant or; each escutcheon being surmounted by an episcopal mitre. The monument is strengthened by light buttresses of three stages, terminating in pinnacles; and the whole capped by an open parapet, and surmounted centrally by a handsome ogee canopy with crockets, finials, and pendants.

The general effect is certainly very beautiful, but if we were to hazard a criticism, which we do with great deference, it would be that the delicate columns from whence the arches spring, belong rather to the early English than to the perpendicular style.

POETRY.

EPITAPH. By Mrs. HANNAH MORE.

In Memory

Of Anna *and* Emma, *tenderly beloved daughters of* Thomas *and* Ann Dicey, *of Claybrook Hall, in the County of Leicester, who delighted in the service of their God and Saviour, and were anxious to point out to others the paths of true religion. Anna died 5th October,* 1801, *aged* 20; *Emma died* 23*rd April,* 1803, *aged* 22.

Sweet pair! from life, love, friendship snatched away
When your fair dawn announc'd so bright a day!
Where now the hopes your blooming virtues raised,
Where now each grace parental fondness prais'd!
Friends to the friendless poor! where now are fled
The tongue that taught them, and the hand that fed;
Yet not *untimely* snatch'd, that Power which saw
His promise was your trust, *His* word your law;
Whose eye the present as the future sees,
For service unperform'd your meed decrees,
Cuts off from life its sorrows, sins, and cares;
Its toil abridges and its suffering spares,
In mercy views the deed, design'd as done,
And gives the prize before the race is run.

NOTICES OF INSTITUTION LECTURES.

During the year 1834, four courses of Lectures have been delivered in the theatre of the Bristol Institution.

1. In the month of January, eight Lectures upon Elocution, by Mr. Thelwall; and subsequently three supplementary Lectures. These lectures were attended by a very large number of persons, being deservedly popular. They formed the last complete course ever delivered by Mr. Thelwall, who died suddenly, at Bath, shortly after their conclusion.

2. In the month of March, three Lectures upon Egyptian Mummies, Egyptian Antiquities, Hieroglyphics and the Rosetta Stone, were delivered by Dr. Prichard and Mr. Clark. These lectures were delivered at the request of the Institution, Mr. Garrard, the chamberlain, having liberally presented two mummies.

3. In April, Mr. S. Worsley delivered a course of ten Lectures on Geology, which were justly and universally popular, being clearly and concisely arranged, and well delivered; they were illustrated by a very large number of drawings and specimens. Both these and the last course were delivered for the benefit of the Institution.

4. In November, a course of ten Lectures on Chemistry was delivered by Mr. R. Addams, whose abilities as a lecturer, and success as an experimenter, have long been known and appreciated in this city.

Upon the books of the Institution, are notices of three courses of Lectures for the present year.

1. Upon the Oxy-Hydrogen Microscope, by Mr. W. West, of the Observatory, Clifton.

2. Upon the Comparative Anatomy and Physiology of the organs of the Senses, by Mr. Clark.

3. Upon the Bone Caves of England and the Continent, by Rev. D. Williams, of Bleadon.

[In April will be published, No. II. of this Journal, which will contain continuations of the Geological, Zoological, Classical and Ethnographical articles of the present number, and many new articles; among which will be the first part of an Essay on Caerphilly Castle, containing a more ample account than any previously published of the military construction of that ancient fortress, illustrated by plans and sections.—Ed.]

J. CHILCOTT, PRINTER, WINE STREET, BRISTOL.

WEST OF ENGLAND JOURNAL

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No. II. APRIL, 1835. Vol. I.

PART II.—LITERATURE.

ESSAY ON THE WRITINGS OF HESIOD,

PRINCIPALLY COMPILED FROM SOME MS. LECTURES DELIVERED AT OXFORD BY THE REV. J. J. CONYBEARE, PROFESSOR OF POETRY.

Communicated by his brother, the Rev. W. D. Conybeare.

ON THE THEOGONY.*

(Continued from p. 11.)

Among the Hesiodean remains of which we have in this article undertaken the illustration, the Theogony of that poet may well claim our earliest notice. Independently of the high poetical merit of many of the descriptions and other embellishments which we shall find interwoven,† and even making every allowance for much apparent inequality of original composition, and the many injuries which must have been sustained, as we have already seen, in the course of a long memorial transmission through such a channel as the oral recitations of rhapsodists, still there must ever remain one great argument which alone would render this piece of the highest value and importance in the estimation of every student of Grecian poetry, namely, its character as the richest original source of the whole poetical mythology so intimately blended throughout almost every work of fancy of that singular nation, δεισιδαιμονεστεροι, excessively addicted to their wild superstitions in almost every verse they penned. Herodotus places

* The original Lectures having been principally confined to poetical criticism, and only touching very cursorily on Mythology, most of the observations in our present article relating to that subject are strictly original.

† Especially the war of the Titans against Jupiter, doubly interesting to us as having afforded the prototype for much of our own Milton's war in heaven.

the name of Hesiod before that of Homer, when he assigns the following as the peculiar character of their compositions:—"These were the first who fabricated a Theogony among the Greeks, attributing to the gods their titles, distinguishing their honours and arts, and indicating their forms."—(Euterpe, c. 53.) We therefore find a knowledge of this mythological system as developed in its earliest sources, of the very highest importance in the illustration of the later poets, who from hence borrowed almost every thing; even that, which might at first sight have appeared among the boldest and most original conceptions of subsequent genius, may often be traced to this source. Thus if we turn to that Grecian drama, which, above all others, bears the especial impress of a powerfully inventive mind, the Prometheus of Æschylus, we shall find him indebted to Hesiod, not only for the original fable concerning Prometheus, but those bold personifications, ΚΡΑΤΟΣ and ΒΙΑ, Power and Force. These inevitable and irresistible ministers of Jove's will had long before been enumerated by Hesiod, among the offspring of Styx and Pallas, in a passage which we shall hereafter have occasion to quote, and we shall then see reason to refer them to the very earliest period of this Mythology—a period anterior to the separation of the various branches of the Indo-European race. One of the most interesting speculations, indeed, connected with the history of the classical Mythology, would be the endeavour to institute a comparative view of the various Theogonies which have descended to us from the ancient nations, between whom a close connection and frequent interchange of superstitions may be traced, not only in those cases where the affinities of language point them out as the kindred offsets of a single great national family; but even where the affinity is so much more remote as scarcely to be traceable by the comparison of languages.* Thus we shall find the distinct national families of Phœnicia and Egypt, often exhibiting the most manifest mythological agreement with the various branches of that widely spread and very remarkable original race, which, having its probable cradle in India or Persia, has diffused languages marked by the most evident identity of grammatical structure and essential substance over the whole of Europe, with the exception of the small corner occupied by the Basque, and the Tartarian colonists, who early possessed Finland, and in the tenth century invaded and established themselves in Hungary. On the Mythology

* In the case of Greece, this interchange of mythologies is very easily to be accounted for. Its earliest civilization was avowedly introduced by foreign colonies from Egypt and Phœnicia. Athens owed its foundation to the Egyptian Cecrops, and was by him consecrated to the worship of his native goddess, Neith, whose name the Greeks, by a transposition of letters, converted into Athene, the Roman Minerva. The date of this is placed by the Arundel marbles more than 1500 years before our æra. Within a century, Danaus led a second Egyptian colony to Argos, which was so influential, that Danai became one of the collective names for a large proportion of the southern Grecians. Herodotus (Lib. ii.) informs us, that the Greeks borrowed the titles of their twelve principal gods from Egypt. About the same time, Cadmus

of the oriental branch of these nations, the researches of our countrymen, commencing with the illustrious Sir W. Jones, have thrown the fullest light. The scholars of the north have equally illustrated the Scandinavian systems of the Edda and Voluspa; and in another article of the present number will be found an account of the deities of the Slavonian branch, by one of our contributors, who has also published a well known work on Egyptian Mythology.* The circumstance just mentioned will of course properly prevent the present writer, as a brother contributor, from expressing any opinion on its merits; but he trusts that he shall be excused for freely availing himself of its researches.

With regard to the Phœnician mythology, the most copious information preserved to us is to be found in the extracts given by Eusebius, in the first book of his "Evangelical Preparation," c. 10. from the compilation of Philo Byblius, a writer of the time of Hadrian, professedly derived from the works of Sanchoniathon, a Phœnician, anterior to the age of the Trojan war.

Many of the names of deities here given are clearly genuine Phœnician, being evidently appellations of the Semitic class of languages, e. g. Ελωειμ, gods, אלהים; Ελιων, the highest, עליון; Συδκ, the just, צדק; Μισορ, easy to be dissolved, משור; Μωτ, death, מוש, &c.

Philo Byblius has given us, professedly on Phœnician authority, a version slightly modified, of most of the leading features of the earlier portions of the Hesiodean Theogony, viz. the Titanian descendants of Ουρανος and Γη, Heaven and Earth, including Κρονος, the Saturnus of the Romans; the rebellion of the latter against his father, and the peculiar nature of the injuries he inflicted on him; but in the subsequent portions the resemblance fails. The same deities are introduced, but under very different relations. We may however occasionally suspect Philo Byblius himself of a few accommodations, calculated to bring his Phœnician materials nearer to a Grecian type.

Another extract from a work of his concerning the Jews, in which he gravely tells us that "Israel was the Phœnician name of him who, on his apotheosis, became identified with the planet Saturn, and who had an only son named Ieud," is assuredly calculated to shake our confidence in his fidelity and judgment. But although it be certain that Philo Byblius is entirely incorrect in applying these notions to the origin of the Jews, it is nevertheless not improbable that he may have been led into error by an identity of

planted a Phœnician colony in Bœotia, and founded Thebes. He introduced the use of letters; and the Semitic names and forms of the Greek alphabet fully attest the truth of this history. We cannot doubt but that he likewise introdued the Saturnian worship of his own country.

* The principal original authorities are the 2nd book of Herodotus, the 1st book of Diodorus Siculus, (entirely occupied by a very elaborate treatise on Egyptian mythology,) and the treatise of Plutarch on Isis and Osiris.

name in one instance, and a near resemblance in the other : for it is assuredly very likely that the title Israel, ישראל, a prince with God, which, from the genius of those languages, would equally denote God the Prince, may have been applied by the Phœnicians to their sovereign deity; and IHID, יחיד, which really is the epithet of an only begotten, may easily have been confounded with Judah, or IHUDE, יחודה, though the latter is derived from a different root, signifying praise.

Interesting, however, as would be the comparison of the Theogony which we are now about to examine, with other kindred forms of superstition, our present limits, and the nature of this article, must prevent our doing more than thus briefly indicating the sources from which the materials of such a comparison may be derived; and occasionally pointing out, as we proceed in our survey of the Hesiodean system, some of the more striking points of resemblance; leaving it to others who may have more leisure and ability, to pursue in its detail a question, assuredly not among the least important of those connected with the history and aberrations of the human mind. At present we shall confine ourselves to a few preliminary observations concerning the general nature of the subject, which appear to us calculated to throw a material common light over the topics which the Theogony of Hesiod must necessarily bring before our minds.

This Theogony, like all the other ancient mythologies to which we have alluded, will be found to have its original foundation very manifestly laid in the attempt to personify, or rather deify, the various physical powers and operations of the material universe; and, more especially, the productive and prolific energies of nature. Chaos, the rude and unformed original state of matter, (for the ancients appear in no case to have attained to the ideas of a proper creation,) is the great *original and eternal* principle; hence springs the earth, the prolific *mother of all,** whence the heaven (naturally confounded with the immediate circumambient atmosphere) emanates; and by a natural analogy, suggested by the fertilizing influences of its showers,† is assumed as the male, as the earth is as the female universal parent, although the former character often very naturally passes over to the solar deity—the Osiris of the Egyptian systems.‡ This deifi-

* Thus Lucretius :—

"Linquitur ut merito maternum nomen adepta
Terra sit, e terrâ quoniam sint cuncta creata."—L. v. 796.

† Thus Virgil :—

"Tum pater omnipotens fœcundis imbribus æther
Conjugis in gremium lætus descendit, et omnes
Magnus alit magno commistus corpore fœtus."—Georgic. L. ii. v. 324.

The reader will find an host of passages of a similar tendency in Prichard's Egypt. Myth. p. 41, &c.

‡ Osiris, (otherwise spelt Isiris,) as the great masculine soul of nature, agrees in character and name with the Indian Siva, whose epithet as the god of production is *Iswara:* but Siva, also, in his form of Rudra, typifies the antagonist principle, or

cation of the powers of nature necessarily assumes the character of a physical pantheism: but as nature ever presents the struggle of antagonist powers of production and destruction, dualism, or the doctrine of two conflicting divine principles, results; represented in the struggles of the Egyptian Typhon (apparently the Greek Typhœus), of the Persian Ahriman, and of the Scandinavian Lok, against the more beneficent powers; but with these physical allegories many other very incongruous materials become blended.

The purely physical system appears in no country to have long subsisted in a state of unmixed simplicity; and many causes must have concurred in producing this effect. The various representations and ceremonies produced before the eyes of the people, to captivate their imaginations by their pomp, although originally symbolical in their character, could hardly have been so understood by the rude vulgar. Fables would speedily be introduced, to afford a more popular explanation of such hieroglyphic emblems, and the prolific nature of fables has ever been proverbial. The kings of the earth would also (as we have several examples), in these early periods of society, endeavour to strengthen their power, by assuming the names, and pretending to act under the immediate influence of the deities already recognised, and to be incarnations, as it were, of those deities. Hence the systems of idolatry would in every nation very speedily present a confused intermixture of physical allegory, fabulous mythology, and hero worship; and this confusion must have been

destructive power, which in the Egyptian system is assigned to Typhon, as a perfectly distinct being. Osiris, identified by his rites, &c. with the Greek Dionysian Bacchus, presided over the sun; and Isis (said by Sir Wm. Jones to be the Indian Isi) is as the great female soul of nature, sometimes considered as mother earth—sometimes as the moon, naturally enough taken as the female consort of the solar deity. We find, in the same manner, Bacchus and Ceres represented as the solar and lunar deities by Virgil, although the latter name is more usually considered as an equivalent to mother earth.—

> "Vos, O clarissima mundi
> Lumina, labentem cœlo qui ducitis annum,
> Liber et alma Ceres!"—Georgic. i. 6.

The great cause of the confusion which we shall find, in attempting to distinguish and trace out accurately the relations of these various mythological characters, seems principally to arise from the multiplicity of titles, sometimes considered as mere *aliases* of the same principle, taken in its widest sense; sometimes as individual personifications of the several particular attributes of that general principle. Thus Isis, as the great female soul of nature, is justly called *Myrionymos*, possessing ten thousand names: and thus we recognize the earth under the various mythological appellations of Ceres, (taken also as we have just seen for the moon,) Vesta, (taken also as fire,) Cybele, Obs. Rhea, Dindymene, Berecynthia, and Magna Mater. The great confusion hence resulting will be readily understood. Macrobius, in the Saturnalia, has to this effect several chapters, shewing that all the masculine deities may be referred to Apollo as identical.

very greatly increased by the frequent interchange of superstitions, borrowed by one nation from another.

To this also we may add, that even the very foundation of the original system of physical allegory involves in itself one very pregnant source of confusion. For either universal nature may, by a pure pantheism, be represented as a single divine being, as in the "Jupiter est quodcunque vides;" or the different operations of nature may be personified as so many distinct deities: and though we might have fancied à priori, that different nations would originally have adopted and consistently adhered to one or other of these opposite systems, yet I believe in point of fact that we shall find in every known instance, that both of them have been blended together and confounded. All these sources of confusion appear to have acted long before the age of Hesiod; so that, although we shall perpetually be struck by very obvious traces of an original foundation of physical allegory, yet we shall find all the details throughout, blended into the most incongruous and inextricable mixture of metaphysical abstractions, physical powers, moral qualities, and fabulous adventures; defying any ingenuity to succeed in the attempt, which has sometimes been very unprofitably made, to interpret them into any uniform and consistent system of allegory.

The pernicious moral effects, necessarily resulting from a system of which a physical pantheism thus formed the very foundation, cannot be more correctly or forcibly described, than in the words of Dr. Prichard. (Egypt. Myth. p. 269.) "We lose sight of all abstract ideas of creation or emanation. We contemplate the material universe as an infinite frame, endued with a living nature, of which intellectual or moral attributes form no part; while the merely animal or sensual powers are every where celebrated, and exhibited in all the various forms which the luxuriance of a corrupt imagination could develope. Destruction, death, and all its terrors, every where stalk forth in the most appalling shapes. Lust and wanton revelry exhibit in all directions the most obscene and sensual emblems."

Such was every ethnical mythological system in its very foundation, and, in moral character at least, the superstructure was ever consistent: a fear of the gods, as the avengers of perjury, will be found almost the only redeeming point; and this the immediate interests of society always led even the rudest legislators to maintain. The natural moral effects of systems so perverted have been forcibly represented by an apostle, in terms which need not now be repeated: the description is indeed disgusting, but those acquainted with the history of those times well know, that it is in no point exaggerated.*

* See Rom. i. 21 to end. A remarkable illustration of the impure and demoralising tendency of these superstitions, may be found in the seventh book of Aristotle's treatise on Politics, c. 17. The philosopher is there treating of the care to be applied to the preservation of the morals of youth, for which reason he says, the magistrate

We must consider it as one of the motives, which may tend to give to inquiries like the present, into these aberrations of the human mind, an interest far higher in the eye of the Christian student than that of mere curiosity, that they forcibly demonstrate to us the necessity of revelation, to enlighten a world '*which by its own wisdom knew not God;*' and serve to convince us, that nothing less than a real revelation could have preserved among a single people—and that a people comparatively uninformed in other departments of knowledge, a religious system of so excellent purity and truth, while so thick a veil was cast over the face of every other nation; so that it seemed as if a light from heaven beamed freely on the Goshen of Israel, while all around was Egyptian darkness. It is surely with much judgment, that Eusebius, throughout his 'Evangelical Preparation,' employs arguments drawn from this source. Nor can our classical studies be ever applied to a better purpose, than when they are thus made the means of impressing on our minds their need of a better wisdom from above.

After these preliminary remarks, suggested by the general nature of the subject, we may now proceed to the critical examination of the particular poem. Although it is interesting as containing much fancy, many beautiful fictions and picturesque descriptions, conveyed in a style distinguished by great sweetness and ease of language; yet it should not be dissembled, that it is at the same time marked by the greatest inequality of composition. The incongruities of matter and inconsistency of style are often so great, as to have afforded fair grounds to the German critics Wolf and Herman, for their belief, that we do not possess in the Theogony, as it at present stands, any single original body of poetry, but a mere compilation of various fragments relating to similar mythological subjects, digested together by those *minstrels of patchwork strains*, ραπτων επεων Αοιδοι, the rhapsodists. Others, however, may be more inclined to attribute these discrepancies, when they relate to the matter, to the great confusion which, as we have already seen, generally pervades the systems of Mythology; and when they relate to style, to the rude and inartificial structure which usually marks the poetry of an early age. But whatever conclusion we may adopt in this respect, we must at all events allow that the Theogony of Hesiod, as it at present stands, is as remote as possible from the form and constitution of an exact and regular poem. In many passages, as, for instance, in his catalogues of the rivers and their nymphs, the poet presents us with nothing beyond a dry and unadorned list of names; and occasionally, even where the subject would appear to open the most inviting field for poetical amplification and embellishment, he confines himself within

should tolerate no licentious paintings; μηθεν μητε αγαλμα μητε γραφην ειναι τοιωτων πραξεων μιμησιν· ει μη παρα τισι θεοις τοιωτοις, οις και τον τωθασμον αποδιδωσιν ὁ νομος. "Nor should there be any statue or painting, representing actions of this kind; *unless in the temples of certain gods of such a character, to whom the law itself allows an obscene service.*"

the narrowest bounds of the most succinct and jejune narration. Thus in his description of the nuptials of Bacchus and Ariadne, than which no other topic can be conceived more happily accommodated to the uses of poetry, we find only the simple dry and bald statement :—

> Κρυσοκομης δε Διωνυσος ξανθην Α'ριαδνην
> Κερην Μινωος Θαλερην ποιησατ' ακοιτιν.
> Την δε 'οι αθανατον και αγηρω θηκε Κρονιων.
>
> The gold-hair'd Bacchus chose a blooming bride,
> Daughter of Minos, Ariadne fair.
> So Jove from age and death exempted her.

The translation is literal, and by no means more prosaic than the original.

But on the other hand, as a remarkable contrast to this severe simplicity, the author most freely expatiates, on many occasions, which, as we proceed, we shall have occasion to specify, such especially as his descriptions of the warfare of the Titans and the newer gods, Θεοι νεωτεροι; and indulges his poetical genius to an extent which may appear altogether disproportioned to the general tenor and constitution of his work.

If we proceed to a regular survey of this work from the beginning, we shall find at the very threshold a remarkable example of the phænomena, which, as we have said, have led many critics to maintain that the composition, as it now stands, is but a compilation of fragments, from many originally distinct, although similar poems.

The whole poem consists of only one thousand and twenty verses, and of this a very disproportionate portion, more than a tenth, extending to v. 115, is occupied by the exordium, which is made up of an address, or rather repeated addresses, to the muses, strung together in a style of incoherence which we can scarcely believe to have originally proceeded, even from the most inartificial of poets. In these we sometimes find sentences the most abrupt, and without the slightest bond of coherence: sometimes we observe the very same ideas repeated over and over again, with a very trifling change of expression. In his remarks on this passage, Herman, treading in the steps of Wolfe, believes that he has detected the substance of no less than seven exordia, originally appertaining to distinct poems, now blended together into one ill-associated mass. With a plausibility and ingenuity, at least, which all must admire, he has drawn out the whole of these distinct exordia; but as his remarks will be found at length in the edition of the Greek minor poets, now most popular in this country, (that of Gaisford, Oxford, 1820,) and therefore may be at once consulted by every one interested, we need not further dwell on his views at present.

But at whatever conclusion we may arrive concerning the doubtful original form of this exordium or exordia, there can be no doubt that many of the detached passages are marked by a very consummate degree of poetical beauty; nor can we need a better example than the very commencement of the poem as it at present stands :—

Μουσαων Ἑλικωνιαδων αρχωμεθ' αειδειν,
Αιθ' Ἑλικωνος εχουσιν ορος μεγα τε ζαθεον τε
Και τε περι κρηνην ιοειδεα ποσσ' απαλοισιν
Ορχευνται, και βωμον ερισθενεος Κρονιωνος·
Και τε λοεσσαμεναι τερενα χροα Περμησοιο,
Η Ἱππουκρηνης, η Ολμειω ζαθεοιο
Ακροτατω Ἑλικωνι χορους ενεποιησαντο
Καλους, ιμεροεντας· επερρωσαντο δε ποσσιν.
Ενθεν απορνυμεναι κεκαλυμμεναι ηερι πολλη
Εννυχιαι ϝειχον, περικαλλεα οσσαν ιεισαι

Now from the muses let our strain commence,
Who fondly haunt the vast and sacred brow
Of Helicon; around its violet spring,
And altars of the high Saturnian Jove,
With tender feet they dance, their delicate limbs
In Hippocrenè or th' Olmeian streams
They bathe; then with firm step they joyous bound;
And so those fair and lovely choral trains
Proceed along the loftiest mountain crest,
Or thence descending at night's darkling hour,
Shrouded in shadowy mist they tread earth's plains,
And pour their voice of passing loveliness.

Here the admiration of every competent judge must at once be excited by the delicacy and sweetness of the language. The passage is, indeed, a most beautiful specimen of that middle style of composition, in which Hesiod has ever been reckoned to excel: the images themselves, distinguished by their own native beauty, are further embellished by a selection of phraseology, which indicates no vulgar taste; in which the appropriate and picturesque epithets, applied to the persons and scenery, claim our especial notice—a praise which Hesiod may justly share with Homer himself. But if, in these remote scenes and distant ages, we are still so much captivated with the beauty of this passage, how much more warmly must it not have affected the immediate countrymen of the poet himself, residing in a valley at the foot of the muse-haunted Helicon, sketching in his verse the picturesque features of the scenery with which he was most familiar, and embodying the local superstitions with which his own mind was most deeply embued. We may almost fancy the poet at the close of evening listening, in the murmurs of the breeze, for the mystic voices, and watching, in the uncertain gloom of twilight, for the shadowy forms he has so exquisitely described.

This highly ornamented introduction is followed by an enumeration of the gods and goddesses, in whose honour the muses pour forth their strains, consisting of a mere dry list of names and epithets, without the slightest pretension to poetical beauty. A similar recital of the subjects of their songs is, with some change of form, again and again repeated in different parts of the present exordium, affording a strong argument in favour of Herman's hypothesis, that it is made up of various fragments originally distinct.

We have next the account often alluded to by later poets, when they mention Hesiod, of the appearance of the muses to him, "ascræas dum sequeretur oves," while tending his flocks on the slopes of Helicon. We are told how they summoned him from this occupation, which they describe in no very complimentary terms :—

Ποιμενες αγραυλοι, κακ' ελεγχεα, γαστερες οιον

"Rustic shepherds, sad disgraces, mere gluttonous bellies."

And how they placed a laurel sceptre in his hands, and inspired him with divine song, charging him ever to begin and close every strain with their own praises. In all this there is little poetical merit; but one of the most striking portions of the exordium immediately follows :—

Τυνη, Μουσαων Αρχωμεθα, ται Δι Πατρι
Ὑμνευσαι τερπουσι μεγαν νοον εντος Ολυμπου,
Ειρευσαι τα τ' εοντα, τα τ' εσσομενα προ τ' εοντα,
Φωνῃ ὁμηρευσαι· Των δ ακαματος ρεει αυδη
Εκ στοματων ηδεια. Γελα δε τε δωματα Πατρος
Ζηνος εριγδουποιο, θεᾶν οπι λειριοεσσῃ
Σκιδναμενῃ· ηχει δε καρη νιφοεντος Ολυμπου,
Δωματα Αθανατων. Ἀι δ' αμβροτον ουσαν ιεισαι,
Θεων γενος αιδοῖον πρωτον κλειουσιν αοιδῃ.

Begin we from the muses—whose blest strains
Charm the vast soul of father Jove himself,
Within th' Olympian halls; the while they sing
In chaunts accordant; forth their sweet voice flows,
And knows no languid pause, while all around
The mighty thunderer's heavenly palace smiles
Pervaded by those flowery-breathing sounds—
Olympus echoes through each snowy peak
Around th' immortal mansions, while they hymn
With voice ambrosial all the sacred race.

The subject of their divine strains is then specified to be, in exact agreement with that of Hesiod's own poem, first Uranus and Ge, (the deified essences of heaven and earth); then the first race of gods descended from them; and lastly, the secondary cœlestial dynasty of Jove, and the race of men and giants. The descent of the muses from the embraces of Jupiter and Memory is then recorded, and their names specified; but we find little to attract any particular notice, before the following striking description of the gifts bestowed by Calliope, chief of all the muses, on those princes of earth, whom she and her sisters honour:—

Η γαρ και βασιλευσιν αμ' αιδοιοισιν οπηδει.
Οντινα τιμησουσι Διος κουραι μεγαλοιο,
Γεινομενον τ' εσιδωσι διοτρεφεων βασιληων,
Τῳ μεν επι γλωσσῃ γλυκερην χειουσιν εερσην,
Του δ' επε' εκ στοματος ρει μειλιχα· οι δε νυ λαοι
Παντες ες αυτον ορωσι, διακρινοντα θεμιστας
Ἰθειῃσι δικῃσιν· ο δ' ασφαλεως αγορευων,
Αιψα τε και μεγα νεικος επισταμενως κατεπαυσε.

Τουνεκα γαρ βασιληες εχεφρονες, ουνεκα λαοις
Βλαπτομενοις αγορηφι μετατροπα εργα τελευσι
Ρηιδιως, μαλακοισι παραιφαμενοι επεεσσιν.
Ερχομενον δ' ανα αστυ, θεον ως, ιλασκονται
Αιδοι μειλιχιη, μετα δε πρεπει αγρομενοισιν·

She on the sacred steps of sovereigns waits—
Kings by Jove cherish'd—on whom e'er have smil'd*
Jove's virgin daughters at his natal hour,
Honouring, and shedding all their sweetest gifts;
Then honey'd eloquence, and tuneful voice
Stream from his lips, till all the people gaze
With fixed attention to his rightful meed
Of Judgment; he securely bends at will
And calms the angry passions of the crowd.
For therefore is superior wisdom given
To monarchs, thus with soothing words to change
The people's madden'd purpose, when they rush
To self-destruction.—So he honour'd stands
Above th' assembled throng, or if he pass
Along the crowded streets bland reverence all
Pay to his footsteps, as a present god.

The poet proceeds to shew, that the influence of the muses is as great a blessing in soothing the private distresses, as allaying the political disturbances of mankind.

ὁ δ' ὄλβιος ὅντινα Μοῦσαι
Φιλεῦνται· γλυκερή οἱ ἀπὸ στόματος ῥέει αὐδή.
Εἰ γάρ τις καὶ πένθος ἔχων νεοκηδέϊ θυμῳ
Αζηται κραδίην ἀκαχήμενος, αὐτὰρ ἀοίδὸς
Μουσάων θεράπων κλεῖα προτέρων ἀνθρώπων
Υμνήσῃ, μάκαράς τε θεούς, οἳ Ὄλυμπον ἔχουσιν.
Αἶψ' ὅγε δυσφρονέων ἐπιλήθεται, οὐδέ τι κηδέων
Μέμνηται, ταχέως δέ παρέτραπε δῶρα θεάων.

Bless'd be the poet whom the muses love
From whose lips flow smooth streams of melody.
For mark—should some sad wretch beneath the stroke
Of fresh calamity yield all his soul
To woe.—If then the servant of the nine
Or hymn the blessed gods that rule above,
Or sing the glorious deeds of former men;
Oblivion quickly steels o'er all his griefs,
And memory holds the pangs it felt no more.
So soon the muses' charm can change our mood.

(To be continued.)

* We are here reminded of Horace's address to Melpomene:—

Quem tu Melpomene semel
Nascentem placido lumine videris.

ETHNOGRAPHICAL MEMOIR
ON
THE NATIONS OF SLAVONIAN RACE.—Part II.

Of the Superstitious Customs and Mythology of the Slavonic Nations.

The mythology and superstitious customs of ancient nations, constitute an important and interesting feature in their history : they may be said to form a part of the ethnography of particular races of men, not less striking and often much more permanent than other traits in their social and moral character, being less liable to be influenced by local and contingent circumstances, or changes of external condition. We have less information respecting the mythology of the Slavi, than regarding that of most other European nations. This has arisen from the fact that they were destitute of any mythic literature, or even traditional poetry, while the Celtæ had their bards, and the Germans their scalds, sacred poets, who, like the rhapsodi of the Greeks, preserved in metre and rhythm the history of men and gods, handed down by a long succession from early times. All that we know of the Slavonian Mythology is to be gathered from foreigners, who were imperfectly, or not at all acquainted with the language of the people, who therefore could not penetrate their meaning and habits of thought, and could only describe the external traits of their superstition, or give such accounts of it as they derived from information, of which we cannot trace the sources or estimate the correctness. One passage of Procopius contains nearly all that has been discovered in the works of the Byzantine writers, with reference to the religion of the Slavi. We have, however, from later times, much more copious accounts in the writings of the older German historians, some of whom have described the Slavonian tribes in their conflicts with the people and princes of Germany. Their curiosity seems to have been excited by the obstinacy with which the Wends of the North adhered to their old barbarous superstition, and opposed their dark prejudices to the spreading light of Christianity. Their firm adherence to the customs of their forefathers, by preserving down to a late period the practices of antiquity, has been favourable to our information respecting them. The worship of heathen gods among the Obotrites, or Wends of Mecklenburg, reaches down within the historical age of Germany, to a period at which we might look for authentic and correct accounts. There are three German historians of the middle ages, who are regarded as principal sources of information on the mythology and worship of the Slavi. The first of these was Dithmar, a count of Waldeck and bishop of Merseburg. This writer lived at the beginning of the eleventh century, at a period when the idolatrous worship of the Obotrites at Rhetra, which was its principal

centre, had been restored after a temporary abolition, effected through the zeal of Christian missionaries and princes. He wrote a chronicle of the history of Henry the First, and the three Othos, and died before the year 1030. His work was published at Helmstadt, in 1667, and was included by Leibnitz in his Collection of the Brunswick Historians. The second writer is Adam of Bremen, who lived in the same century, had much intercourse with the Wends, particularly the Wagrians or Wends of Holstein, and wrote an ecclesiastical history, extending from the year 778 to 1072. A third writer is Helmoldus, whose history of the Slavi, or Chronica Sclavorum, was published by Henry Bangert, at Lubeck, in 1702. These three historians treat almost exclusively of the western branches of the Wends, in Mecklenburg and Holstein. There are a few scattered notices to be collected from other writers, respecting the superstitions of the more eastern tribes of the same stock, as the Sorabians, the Moravians, Bohemians, Poles, and Russians. Lastly, considerable light has been thrown on the same subject, by the remains of statues and figures of the Slavonic gods, and the implements of superstitious rites which have been found in different parts of the Wendish country, and particularly, as we shall have occasion fully to observe, by some curious and unexpected discoveries of this description in Mecklenburg.

The following is a literal translation of the passage in which Procopius sums up the result of his inquiries concerning the mythology of the Slavi who inhabited Pannonia, and infested the northern provinces of the empire in his time.

"The Σκλαβῆνοι" says Procopius, "worship one God, the maker of lightning—*τὸν τῆς ἀστραπῆς δημιουργόν*. They regard him as the sole ruler of the universe, and sacrifice to him oxen and victims of all descriptions. They know nothing of fatality—*εἱμαρμένη*; nor do they allow it to have any influence on human affairs; but when they apprehend that death is near at hand, either under the pressure of disease, or when incurring the dangers of war, they utter vows that they will perform sacrifices to God for their lives, if they survive: after escaping, they fulfil their vows, and believe that their safety has been purchased by the said sacrifice. They likewise pay veneration to rivers and nymphs, and some other inferior divinities. To all of these they perform offerings, and make divinations in their sacrifices."*

This account of Procopius coincides, in many respects, with the statements given by the German historians above mentioned, relative to the superstitions of the western Slavi. The assertion that the Slavonic nations, notwithstanding their apparent polytheism, and the worship paid by them to many inferior deities, believed in the existence of one supreme God, under whom all the rest acted as subordinate agents, is repeated by Helmoldus in a passage which has been cited from him by Hôfprediger

* Procop. Cæsar. de Bello Gotth. lib. 3. cap. 4.

Masch: "Among the various deities whom they suppose to preside over fields and forests, pain and pleasure, they nevertheless confess one more powerful God in heaven, who rules the rest, and employs himself merely in heavenly affairs. The other gods they believe to follow separate duties, and to be his offspring: and the nearer each is to that God of gods, the better they consider him." Karamsin, the learned historian of the Russian empire, is persuaded, by the authority, as I suppose, of these writers, that "the Slavi, in the midst of their foolish superstitions, believed in the existence of one all-powerful Divinity, to whom the immensity of the skies, embellished with the sparkling light of the stars, formed a temple worthy of his supreme greatness; who, while his attention was occupied with higher matters, confided to his offspring the government of the earth. To him, as Karamsin supposes, the Slavi erected no temple, being persuaded that mortals can hold no communication with him; and that in their necessities they must have recourse to gods of a second order, whose office it is to give timely aid to brave and virtuous men." The writer last cited is of opinion, that this deity of the universe was the god whom the Slavi termed Velibogc, or *the white or beneficent god.** It was, however, supposed by Masch, to whose work we shall have frequent occasion to refer, that Velibogc was the epithet, not of one divinity, but of all the benevolent genii worshipped by the Slavi. It seems, from Helmoldus, that the name had this meaning; and that while the benevolent genii were termed white, or veli, in the Slavonian language, the devils or malevolent genii, were termed Tschernebogc, or *black divinities.*

Helmoldus likewise distinguishes the divinities of the Slavi into two orders; namely, the gods who resided in temples, and those who were supposed to dwell in woods and forests. The images of these, however, were also occasionally found in temples. In the first class he reckons Podaga, as well as Radegast: to the latter, Prowe and Purcunust, the god of thunder. Purcunust stood in an oak tree in Romore, in Prussia; he had also his statue at Rhetra, in the temple of Radegast. The temple at Rhetra was the most celebrated seat of Slavonic superstition. It lasted until the time of the three historians above mentioned. In the isle of Rugen, in Arcona, were the temple and statue of Zwantewith, as Helmoldus terms him, who was the most celebrated among the benevolent genii of many Slavonian tribes, and even received presents from the christian kings of Denmark. The name of this god is supposed by many writers to have been more correctly, Swetovid, or the *Image of Light.* They suppose him

* *Veli*, is white in the Slavonian language: Bog, or Bogc, means *divinity* in several dialects, as it did in that of the old Bulgarians, according to information conveyed by the following passage in the "Panoplia Dogmatica" of Nicetas Choniates Acominatus:—

Βόγ ἡ τῶν Βουλγάρων γλῶσσα καλεῖ τὸν Θεόν.

Montfaucon. Palæog. Græc. p. 333.

to have been the Phœbus of the Slavi. In one of his hands he held a bow; in the other, a hornful of wine, or more probably of beer.

After all, we should have had but a vague idea of the style of Wendish idolatry, had it not been for a curious discovery made in the Mecklenburg country, of a series of images and other relics, which appear to have been the paraphanalia of a temple of Radegast. An account of this discovery is contained in work by Hôfprediger Masch, from which the following is an extract.

The whole collection of those antiquities, as well as some pieces which have been irreparably lost, was found near the town of Prilwitz, in Mecklenburg, not in the ruins of the old citadel, which is in the middle of the village, but on the north side of the mountain, not far from the shore of the lake of Tollentz. They were contained in large metal jars, covered with Runic inscriptions, in which they appear to have been carefully buried. The discovery was made by the pastor of the village Frederic Sponholtz; and therefore previous to the year 1697, when he died. The garden belonging to the clergyman joined the north side of a high mountain, near the bank of the lake. When the parson was planting a tree in his garden, he cut away a part of the bank, discovered these relics, and took them into his possession. He concealed his discovery. After his death, his widow sold a part of his collection, together with two sacrificial vessels, in which they were contained, and some iron instruments, to Pälke, a goldsmith in New Brandenburgh. The two sacrificial vessels were used by a brass-founder, for casting church bells. Most of the antiquities were preserved. Masch has given a particular account of Sponholtz, a goldsmith in New Brandenburg, and of his relationship to the parson, Sponholtz of Prilwitz, in consequence of which they came into the possession of the latter. A physician, named Hempel, got some knowledge of the existence of these treasures, which had been long kept secret, and published an imperfect account of them. The first complete description of them, however, was given to the world by Masch, the author of the work of which I have before spoken. Masch's work attracted a great deal of attention in Germany; and it is referred to as one of high authority, by writers on the antiquities of the Slavonic nations, particularly by Dobrowski and Karamsin. The most interesting of these remains are brazen statues of the Slavonian gods, cast evidently by native artists. The skill of these artists was not sufficient for founding a whole statue at a time, and in one place: the different parts appear to have been cast separately, and afterwards put together.* By means of the Runic inscriptions on these statues, most of the principal deities of the Slavonians have been recognised. I shall enumerate the most remarkable of them, with reference to the copies of Masch's representations, and extract some of his remarks.

* Karamsin has observed that traces are found in the Iliad of this method of manufacturing gods.

RADEGAST.

Among different tribes of the Slavi, different objects of worship obtained the chief regard.* Zwantewith was adored by the Sorabians, or Wends, of Lusatia; Peroun, or the god of thunder, by the Muscovites, and other nations of the east. Among the Obotrites, or Wends of Mecklenburg, Radegast was the favourite, or tutelary god, by whose assistance the Rhedarians, or people near the lake of Tollentz, expected, according to Helmoldus, to get the better of their neighbours in warfare. There was a famous temple of Radegast in the city of Rhetra, which was one chief centre of barbaric opulence in northern Europe during pagan times. The city and temple have been described by Dithmar of Merseburg and by Adam of Bremen, who lived previously to the final conquest of the Wends, and the entire destruction of their idolatry. The history of Rhetra holds an important place in that of the Wendish nation. The city, with its temple, twice underwent a total destruction. It was overturned, and the temple burnt in the year 955, in the reign of the emperor Otho: the image of Radegast, and all the treasures accumulated during ages of pagan devotion, were given up as a spoil to the bishop of Brandenburg. The obstinate idolaters rebuilt their city, and reinstated the rites of their divinity, anxious to restore to them their former splendour. After the lapse of two centuries, in 1150 and 1157, under the government of Henry the Lion, Rhetra and its temple were finally destroyed and burnt; and, as far as it could be done, every vestige of the worship of the Wendish divinities carefully obliterated. From these historical facts, Masch endeavours to explain the discrepancies between the accounts given of Rhetra, by Dithmar, and Adam of Bremen. He says the former describes the new temple of Rhetra, as it was restored after its destruction by Otho: and that Adam collected the notices which he could obtain of the older and

* See an enumeration of the tutelary or favourite gods of particular tribes, in Masch, p. 29.

more magnificent edifice. The following is a translation of the passages to which reference has been made in both the authors to whom we are indebted for these accounts.

"There is," says Dithmar, "in the country of the Rhedarii, a certain city, by name Riedegast, (so he terms the town, after its tutelar divinity,) of a three-horned shape, having three gates, one in each horn; surrounded on every side by a vast wood, held sacred, and untouched by the inhabitants. Two of the said gates are open to all comers; the third, which is towards the east, and is the smallest, leads, by an obscure path, to the adjoining sea. Near this path there is a temple, curiously built of wood, which is supported on the horns of different beasts. The walls of this temple are curiously adorned with figures of gods and goddesses sculptured upon them, as it appears to those without; but in the interior stand the statues themselves, fearfully dressed, the names of each being cut on their caps or coats of armour. There are likewise the standards of the gods, which are never moved from the temple, except in military expeditions. In order to preserve all these sacred things, ministers are appointed specially by the natives, who, when they meet to sacrifice to the idols, or to appease their anger, sit, while the others stand round, and muttering to each other inaudibly, dig holes in the earth with gestures, and then, throwing in lots, inquire into the events of dubious things. In each different region there is a different temple, and different images are worshipped by the pagans; but the city and temple above mentioned occupied the principal place. When they go to war, they salute this, [image] and when they return, they honour it with due rewards, and inquire diligently by lots, what sacrifice is to be offered to it. The ineffable fury of these gods is mitigated by the blood of men and of cattle."

It is probable that these images which Dithmar mentions, whose names were engraved on their armour or caps, are the very same which were fortunately discovered at Prilwitz.

Adam of Bremen, gives the following account:—"There are other Slavonian nations, who dwell between the Albia and the Oder, the Heveldi, who are near the river Haliola, and the Ronani, the Luibuzzi, the Wiltzi, Stodwani, and many others. Among these the Rhetharii are the most central in situation, and they are the most powerful of all. Their city, most commonly called Rethre, is the seat of idolatrous worship. In it there is a great temple constructed to the honour of demons, of whom the prince is Radegast. His image is of gold; his bed of purple. The city itself has nine gates. It is enclosed on every side by a deep lake, over which a wooden bridge affords a passage, open only to those who resort for the purpose of offering sacrifice or consulting the oracle. From this temple there is a journey of four days, as it is related, to the city of Hammaburg.

After the second and final destruction of Rhetra, its name was totally lost, and its site was unknown. Masch, however, has given good reasons

for believing that it was at Prilwitz, on the lake of Tollentz, where the antiquities which he has described were discovered. There seems to be no reason for doubting that these are the very remains of the temple described by Adam and bishop Dithmar, or rather by the latter, since no golden image has been seen. I now proceed to make some observations on the figures of Radegast, and on the remainder of the images.*

The figures of Radegast represent him with a human body, surmounted by a head, which is either that of a lion or a dog: his eyes are deeply sunk in his forehead: he has a huge mane, which descends to his shoulders: on his leonine head sits a goose. There were no less than five images of Radegast in this collection. I have copied the most remarkable. One of these is dressed in the usual habit of the Wends. It bears the head of an ox in its right hand, before its breast. The Runic letters cut upon different parts of this figure, give the name Radegast Bilbocg, that is, Belibogc, or *White God,* and Rhetra.

Very little is known concerning the particular attributes of Radegast, but from one of his names, Slavaradge, which, in the Wendish language, means *a counsellor of glory,* Masch conjectures that he was a god of war, and this seems indeed to be implied by the passage already cited from Adam, of Bremen. The peculiar meaning of the forms and emblems given to him could only be discovered by knowing more than we can ever know of the mental habits and associations of the people whose imagination produced such a creature. The head of the ox may be symbolical of strength. It is difficult to imagine what attribute could be represented by the goose. Some have supposed that Radegast was originally a Vandal god, and that he was the Vandal king Radegaisus deified. However this may have been, the style of his garnish is rather Slavonian than German.

Vodha.

Next to Radegast, Masch mentions Vodha, as he was termed by the Wends of Mecklenburgh. This, it seems, was the same as the Woden of the Saxons; at least such was the opinion of Masch, in which he has been followed by Karamsin. The worship of Vodha was probably borrowed by the Wends from their Saxon, or other German neighbours, before the conversion of the latter to Christianity, or both the Slavonian and Teutonic nations may have brought it in common from the east. Most writers on the antiquities of the ancient Germans and Scandinavians, since the time of Maillet, have identified the Saxon Woden, or the Odin of the Edda, with the Buddha of the Indian mythology; and we here find a name given to this divinity by the Slavonians, much nearer to the eastern designation,

* "Accounts likewise remain of temples of Slavonic gods at Stettin, (See Karamsin, v. I. p. 118,) and at Arcon, (Ibid. 119.) The former is described in the Life of St. Otho, the latter by Saxo Grammaticus."—See Gebhard's Geschichte der Slaven.

than that under which he was worshipped by our Saxon ancestors. The figure of Vodha is so mutilated, that I have not thought it worth extracting.

PODAGA.

The next figures are those of Podaga. As Radegast was the chief god of the Obotrites, Podaga, according to Herr Masch, enjoyed a high rank among the Wagrians, or Wends who inhabited the present Holstein. His most famous temple was at Ploen; on account of which Helmoldus calls him, Idolum Plunense: Masch supposes him to be one of the original national gods of the Wends, and not among those whose worship was borrowed from the neighbouring nations.

Among the Poles and Bohemians, this god was called Pogwist, which means weather. Among the Sorabian Wends, he was called, not Podaga, as at Rhetra, but Pogada. Frentzel has explained this last name to mean a divinity who gives good weather, and therefore favouring agriculture. Masch says, that Podaga has the same meaning; indicating a god who gives plenty of corn and other food. He adds, that as the Wends expected from Radegast and Vodha, to obtain good luck in war, so they hoped from Podaga the blessings of peace, fair weather, and fruitful seasons. The image of Podaga, at Rhetra, had double figures, and it is difficult to say which is the front. The head of this figure is too large in proportion, and Masch says it is impossible to tell what it is meant to resemble. He says the forehead, the eyes, and the upper lip, had something of the human in them; but the nose resembles that of an ox. He thinks it possible that the artist intended to make Podaga, as well as Radegast, with the head of a lion. Pyramidal rays issue from the head, which are broken. The emblem of Podaga was the cornucopia, which he had in common with Swantewit. Masch supposes that the curved line, notched, and extending down to the figure of a swine, was meant to represent a cornucopia. He supposes also, that the Runic characters engraved on this statue bear allusions to the art of fishing, the use of the plough, and other attributes referred by antiquarians to Podaga. It would be tedious to follow him into his etymological inquiries.

Percunust.

We now come to a divinity more celebrated and better known among other nations than Podaga, namely, Percunust, the god of thunder. The worship of this God was well known in Prussia, Poland, Lithuania, and Russia. His name is variously given—Percuus, Percunust, Parchunst; and Von Westphal calls him Occipirnus. The name Percunust is inscribed on the idol found at Rhetra, which means, according to the author last mentioned, *the god of lightning, thunder, and rain.* Even in Lithuania, in the present day, a storm of thunder is called Parcunust. The anterior figure of this image represents the head of an old man, with a long beard, reaching down to the breast. The body is covered with a long robe, which conceals the feet. The head of the posterior figure, is supposed to be borrowed from that of the destroying god, and to allude to the devastation occasioned by lightning. The name of Percunust is easily read over the head of the posterior figure, in Runic characters; and on the robe of the anterior figure, is an inscription, as follows:—"Percun deuuaite nemusea und man." This is explained in the following way by Lasitius, an old writer on the gods of the Samogitians, or natives of Prussia, who has preserved an ancient Wendish prayer to Percunust. When a storm arose, the Wends of Prussia were accustomed to take a piece of salted swine's flesh, and draw it round their field. After the storm was over, they consumed it with their family, and uttered the following prayer. "Desist, Percunust, and injure not my field; no! I will sacrifice to thee this flesh."

Nemesa.

The preceding gods are not entirely unknown to historical writers. We now come to an idol whose attributes can only be determined by conjecture. The countenance of this figure is, according to Masch, the beau ideal in the Wendish notion of beauty. The forehead and eyes are like the human; the nose is very large, and spread upon the cheeks; the upper lip is very small, and falling in almost closely under the nose, and giving to the jaw the resemblance of a hound's. A broad beard hangs down upon the breast; from the head, on each side,

two thin rays project; and on the head there is the extended figure of a bird. The body is clothed in a short robe: the right hand holds a three-cornered staff; on the left hand sat a bird, of which only the body remains. The most remarkable thing in this statue, is the bird in front of the figure, which seems to be fixed to the robe.

The letters inscribed in this figure are as follows:—on the shoulder plainly stands, "Nemesa;" on the innermost robe is inscribed the word "Arcon," referring probably to the celebrated temple of Arcona, in the isle of Rugen. Masch supposes the name of this god to be Nemesa, not only from finding the name inscribed on the shoulder of this statue, but because the word Nemis is also found engraved, or cut, on the implements of sacrifice, among the remains found at Prilwitz. Nemesa is a name, however, unknown in any of the accounts we have of Wendish Mythology; and the only clue that can be found to the proper office of this god, is the word Arcon. From this, the figure is supposed to be the same as Swantewit, the idol worshipped at Arcona. Masch, however, also offers a conjecture, that Nemesa was the same as Juterbogc, god of light or of twilight, who is said by Von Westphal to have been represented with a head surrounded by rays, holding a staff in his left hand, and supporting in his right a figure of the sun. He thinks that the sun may have stood at the end of the staff which here occurs. On the whole, he is inclined to believe, that this is Swantewit, of Arcona, though it has but one head, while Swantewit is represented with four.

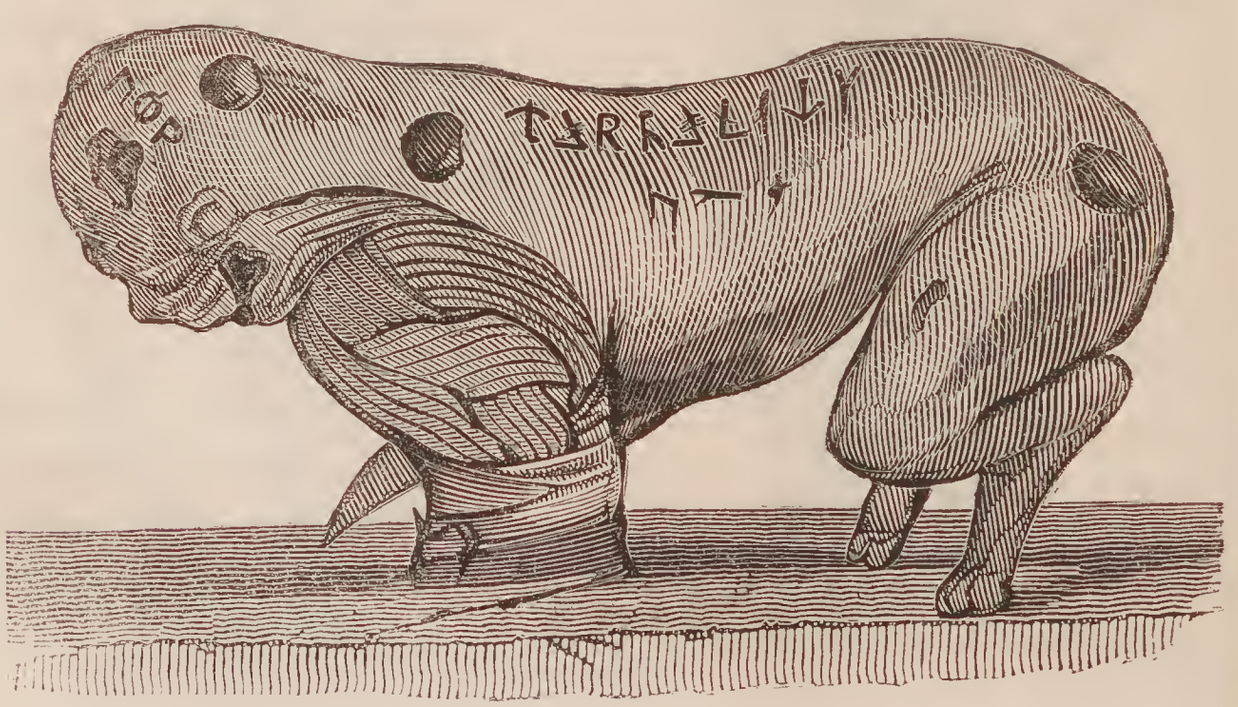
ZISLBOGC.

Whether the function of the last deity was to rule the sun, or not, Zislbogc was the god or goddess of the moon. This statue has a human countenance; the body is, as usual, covered with a robe; the figure of the moon goes through the body. On the left hand hangs down a quadrangular quiver, in which stick five arrows. It seems as if the Wends intended to ascribe to this deity the principal attributes of the goddess Diana.

SIEBA.

The preceding images are supposed to have belonged to male divinities. Sieba, however, is plainly a goddess; she is mentioned by Helmoldus under the name of Siva, Dea Polaborum; the name is supposed by most writers to mean life, which is the signification of Siva, or rather Jiva in the Slavonian languages as well as in Sanskrit. This goddess was worshipped by many of the Slavonian tribes. Her principal temple was among the Polabian, or the Wends between Mecklenburg and Holstein, and probably on the hill where the *Domkirche* at Ratzeburg now stands. This figure is much more elegant than the preceding, and it seems as if the Wends were more attentive to the beauty of their goddesses than their male divinities. The head is surmounted by an ape, from which circumstance, and from her name, there is imagined a connection between the Wendish divinity and the fables of the Bramins.

We are now come to the evil genius of the Slavonic nations. "Well known as this god is to the history of the Wends," says Masch, "yet no description of his figure was found before the discovery of these remains. His name is written differently, Czernebouck, Czernbog, Czerneboch,



Tschernebogc:" all these words have only dialectic differences, and mean *the black or the evil god.* Masch supposes, however, that Tschernebogc was not a proper name, but a designation of character, as Velibogc, or good divinity, seems to be, in the statue of Radegast. He thinks that Pya is the proper name of this idol; his figure represents an enraged lion, and on the middle of his back is seen legibly the name Tschernebogc. On the right side is Rhetra, and on the left Pya, in Runic characters.

The images above described, are the most remarkable that were found in the collection of sacred paraphernalia, disinterred by parson Sponholtz, at the lake of Tollentz; and they happen to be specimens or representations of all the principal gods which are described by the German historians, as worshipped by the Obotrites. We must not, however, consider these as exactly constituting the pantheon of all the Slavonic nations. So rude a system of superstition, and one referable to no general principles, was likely to vary, according to the caprice of particular tribes, and under particular contingencies. The favourite object of worship in one district, was in another subject to a different tutelary dæmon of the place. The divinities of neighbouring nations were sometimes blended with the indigenous gods of the Wends, or Slavi. Perhaps this was the case at Rhetra, where Masch supposes that the Wends of that city, being intermixed with old Vandals and other tribes, adopted some of the gods belonging to that people, and some from the Prussians. He even conjectures that Radegast was an intruder in the calendar of the Slavi, and was originally a deity, or warrior of the Vandals. In this, I am disposed to believe him mistaken, because Radegast was worshipped by many other Wendish tribes besides the Obotrites. The following is an enumeration of the gods who held the highest rank among different Slavonian tribes. The Wends of Prussia, according to Hartknoch, held Purcunust,* Picollo, or Potrimpi, for principal divinities. The Sorabians, or Wends of Lausitz, (Lusatia) assigned the first place to Zwantewith and Radegast.† The Moravians worshipped Peron or Pierun, Radgost or Radegast, Witislaw and the Krasopani.‡ The Bohemians, Peron, together with Swantewit;§ the Poles had nearly the same gods. According to the opinion of Alexander Guagnuini,‖ they worshipped the sun, which was the Swantewit, or the sacred light of other Wendish nations; the moon; tempest, which they termed Pogwist; Jupiter was termed by them, Jessa; Pluto, Lacton; Ceres, Nia; Venus, Marzana; Diana, Zievonia; Castor and Pollux, Lelus and Potetus. John Duglossus further adds, that Mars was called Ladu;

* Hartknoch. Diss.—Masch ubi supra.

† Abr. Frenzel de Diis Soraborum in Gottfr. Hoffmanns Scriptorum Lusat. Goslur. 1719.

‡ J. G. Stredowski, Sacra Moraviæ Historiæ, Solislar, 1710.

§ Paul Stransky, Resp. Bohem. Lugd. Bat. 1634.

‖ Descriptio Sarmat. Europ. 1581.

Venus, Djedjielia; and tempests, Pogoda.* It is evident that these last writers were among those persons of narrow and confined views who expected to find among all nations an exact counterpart of the theogonies of Hesiod and Ovid. It is very probable that if we knew something more of the Polish divinities, we should find Zievonia as unlike Diana, and Lelus and Potetus as remote from Castor and Pollux, as Pogwist, of whom we know something under his title of Purcunust, was remote from the Jupiter of Mount Ida.

Other relics besides those which I have mentioned were among the remains discovered at Prilwitz, for an account of which I must refer those who feel curiosity on the subject, to the work of Hôfprediger Masch. I have already enumerated those objects to which the greatest interest is attached on account of the light which they seem to throw on the superstitions of the Obotrites, and the kindred nations.

The collective results of all our inquiries into this subject, though to several important questions, they afford no satisfactory reply, yet enable us to arrive at some definite conclusions as to the general character of the Slavonian Mythology. We have sufficient proof, for example, that the idolatry of the Slavi belonged to that class of pagan superstitions which personify and point out as objects of worship the powers of nature, the most manifest and striking agencies of the elements, and the visible bodies of the universe. To these were added imaginary beings, the mere creatures of human desires and human necessities; still merely physical agents, endowed with powers to suit particular occasions, but having no moral elevation above human nature, and susceptible of influence from human motives of self-interest. As did other materializing superstitions, so that of the Slavi deified not only the productive but likewise the destructive powers of nature. The beneficent demons were to be stimulated by rewards, the malignant to be restrained by bribes from exercising their wonted attributes. We are told by Procopius, and we have observed that the assertion has been repeated in later times, that the Slavi, besides all their host of inferior gods or genii, believed in the existence of one supreme and universal deity. The assertion of a philosophical historian, whose previous speculations on such a subject may have imparted a peculiar bias to opinions derived from confined resources and difficult inquiries, may naturally carry with them some degree of doubt, when unsupported by any trait which indicates a corresponding enlargement of mind. But we cannot contradict the positive declaration of Procopius. On one other particular his information is precise and conclusive. The Slavi acknowledged no fatality; they knew nothing of that mysterous doctrine of destiny, which, coinciding

* Hist. Polon. lib. i. ed. 1711.

as it does with certain forebodings, deeply imprinted on the human mind, has given rise to all that is imposing and most powerfully impressive in the celebrated religions of the pagan world. This characteristic dogma, or its absence, may be said to distinguish into two classes all the forms of heathen superstition. Among the Hindoos it has been traced in the early scriptures of that people; it became gradually more and more disclosed among them, and attained its full expansion in the philosophy of the Sanc'hya school. In Persia the same doctrine was the foundation of Dualism, the theological system of the ancient Magi, and the fated contests between the good and evil principle of which the successive cycles or periods and the final consummation were predestined. Among the Greeks, destiny, ἡ εἱμαρμένη or ἡ πεπρωμένη was the supreme law of the universe: the gods were only blind agents or instruments for bringing to pass the decrees of uncontroulable necessity. We find this doctrine laid down explicitly by the most profound of the Greek dramatists:—

> "Who then is ruler of necessity?
> The triple fates, and unforgetting furies?
> Must Jove then yield to his superior power?
> In no way shall he 'scape his destined fate."

The deep interest diffused over the finest productions of Grecian tragedy has its foundation in this principle. Thence the compassion, mixed with a sentiment of mysterious dread which is excited by the calamities of the Labdacidæ. Wherever this doctrine is inlaid, in all such mythological systems we find traces of a sublime morality, grounded on awful sanctions, the idea of a pure and irrefragable law, which once transgressed, entails woes interminable on the unfortunate victims of Nemesis. The doctrine of a future state, and that a state of moral retribution, forms a necessary part of such a system. It is essential to, and integrally contained in it. Even in the mythological systems of the northern European nations, we trace the doctrine of fated revolutions, of destructive cataclysms, and the restoration of a golden age promised in some remote period of time. I need scarcely refer to the passages in the Edda, the poetical collection of our old ancestors, the Northmen, in which this anticipation is conveyed. The doctrine of the Celtic nations, whose sacred bards uttered long rhapsodies over the tombs of warriors, are imperfectly known to us; but the poet Lucan, at a time when information was not difficult to obtain respecting them, since druids were among the friends or hospites of Roman senators, ascribes to the Celtæ a belief in futurity, or rather in the fated repetition in cycles of the same events, like the doctrine conveyed in the Timæus of Plato. This at least we are led to conjecture, from the terms in which the intimation is expressed:—

> "If dying mortals' dooms they sing aright,
> No ghosts descend to dwell in dreadful night,

No parting souls to grisly Pluto go,
Nor seek the dreary silent shades below;
But forth they fly, immortal in their kind,
And other bodies in new worlds they find.
Thus life for ever runs its endless race,
And like a line, death but divides the space,
A stop which can but for a moment last,
A point between the future and the past."

None of these traits which characterise the most refined systems of pagan mythology, and seem to point to a higher original, can be recognised in the abject superstitions of the Wendish, or Slavonian nations, to which they have adhered with unexampled pertinacity. Their gods are merely the creatures of a rude and uncultivated fancy, the capricious phantoms of a coarse and sensual imagination. We discern no trace of any moral end for which their existence may have been feigned, or of any moral government which they were supposed to have exercised. Their attributes are wholly physical; their existence has reference only to physical wants, and to physical objects. We know not whether a future state was recognised by the Wends; and if it was, we have no ground for supposing that it was a state of retribution, or that this people had any belief in rewards and punishments administered by the gods, either in this or a future state. They performed sacrifices; but whether these sacrifices were piacular, and connected with a notion, implying perhaps too much of refinement and reflection for minds so uncultivated, of guilt contracted and guilt to be expiated or atoned for, we are without any satisfactory information.

Essay on Caerphilly Castle.

No. I.—HISTORY.

It is remarkable that the Castle of Caerphilly, the ruins of which exceed in grandeur and extent those of any other castellated structure in Great Britain, Windsor scarcely excepted, should have remained hitherto altogether neglected, or very superficially noticed, by the historians and tourists of Wales, as well as by the more elaborate writers upon the military architecture of our forefathers.

With respect to the earlier authorities, Caradoc of Llancarvon, Giraldus Cambrensis, and the like, who flourished before the erection of the present edifice, which was probably preceded by one of very inferior dimensions, this silence is readily to be accounted for; but it is certainly singular that it should have been preserved by Lloyd and his commentator Powel, and transmitted almost unbroken by the indefatigable, though credulous author of the "Munimenta."*

* King alludes to, and probably intended to have added a description of it.—He has given views and sections of Castell Côch, a neighbouring fortress.

It is not, however, I am inclined to think, very difficult to divine the causes of the obscurity in which the early history of Caerphilly is involved, and the absence of any historical associations may perhaps be permitted to account for the continued silence of modern writers.

A castle, if not of equal, yet of considerable magnitude, had been erected at a period anterior to, or closely succeeding the Norman conquest, at Cardiff, a position which, from its proximity to the estuary of the Severn, and the embouchure of the Taffe, from the fertility of its subjacent meadows, from the protection which it reciprocally afforded and received from the townsmen, and from its greater distance from the mountains, and consequent diminished liability to be surprised by their crafty and warlike inhabitants, was invariably the chief residence of the feudal lords of Glamorgan; and from hence it followed, as a necessary consequence, that Caerphilly, which from its dangerous proximity they were obliged to retain in their immediate possession, fell into comparative neglect, and although very superior in magnitude to Cardiff, was considered only as its dependency in importance.

It was to the lord of *Cardiff* that the feudatories of Glamorgan owed suit and service, and it was to the castle court of that place that they were bound annually to repair.

The castle of *Cardiff* is not unfrequently mentioned as the death-place of great Norman Barons; it was more than once honoured by a royal guest, and even at the far later period of the parliamentary wars, its acquisition was considered as of great importance.*

Caerphilly, on the contrary, is rarely mentioned by the chroniclers, and seems only on one occasion to have lodged a royal presence, when the second Edward took refuge there for a few hours towards the close of his reign, a few months before he met with that death, which, from other hands, and in a less barbarous manner, he had so justly merited.

These considerations will, it appears to me, fully explain the little notice taken by contemporaries of this magnificent structure, and the consequent dearth of information respecting its fortunes, exercising in the compilation of its history, rather the painful ingenuity of the antiquary, than the discriminating judgment of the historian.

Dine-fawr, or South Wales, appears anciently to have consisted of the shires or divisions of Caerdigan, Dyvet, or Pembroke, Caermarthen, Morgannwc, or Glamorgan,† Gwent, or Monmouth, and Brecheinoc, or Brecknock, six in number; of these Morgannwc contained four cantreds, or hundreds, which were further

Powel's Lhyd, 4to. 1811.

* "In this year, (1645) the royal garrison was driven from Cardiff Castle by Col. Pritchard, and Wales was reduced, but soon after revolted, and Col. Pritchard was besieged in Cardiff, though after succoured."—*Ludlow*, fol. 1751. p. 61.

† Morgannwc seems to have contained a part of the modern county of Glamorgan, and much of Monmouth.—Hugo Le Despencer is styled upon his seal, "Dominus Morganiæ et Glamorganiæ."—*Dalloway's Heraldry*, 4to.

subdivided into fifteen commotes. The names of these cantreds were, *Croneth,* including the vales of the Neath, Avon, and Ogmore; *Pennythen,* the vales of the Ely and Rontha; *Brenhinol,* and *Gwentlhwg,* now forming part of Monmouthshire. The commotes, or subdivisions of *Brenhinol* were, *Cibowr, Senghennyth, Vwchaeth,* and *Iscaeth.*

That the scite of the present castle of Caerphilly was in the cantred of Brenhinol, is a matter of absolute certainty; and there ought to be but little doubt concerning the commote, seeing that the modern hundred is called indiscriminately Caerphilly and Senghennyth.

Soon after the Norman conquest of England, Trahearn ap Caradoc, usurper of North Wales, having been slain in battle, Rhys ap Twdyr and Griffith ap Conan were universally acknowledged as princes, the one over the Southern, and the other over the Northern Britons. Rhys, who had regained his principality by the help of his Irish allies, seems

1088. however to have dispensed with their services rather too hastily, for we find Llewelyn and Einon, sons of Cadivor, late lord of Dyvet, conspiring with Griffith ap Meredith for his overthrow. They were, however, unsuccessful, being themselves overthrown in a pitched battle, after which Griffith was taken prisoner and executed. Einon, who escaped, fled to Jestyn, then lord of Glamorgan, and like himself at war with Rhys, and covenanted with him to invite the neighbouring Normans to their assistance.

Einon, who seems previously to have resided at the Norman court, introduced accordingly Robert Fitz-Hamon, a great baron nearly allied to the conqueror, with a band of adventurers, into Glamorganshire, and by their aid Rhys was speedily vanquished and slain.

The results of this victory raised a quarrel between Jestyn and Einon, and the latter in revenge, recalled the departing Normans from their ships, and persuaded them permanently to occupy the country.

Fitz-Hamon, becoming by the slaughter of his old ally Jestyn, undisputed lord of Glamorgan, fixed his residence at Cardiff, where he probably laid the foundation of the present castle; and dividing, according to the genius of the feudal system, the vallies and plains among the twelve knights who had accompanied him, he left to Einon such parts of the country as were barren and mountainous.

The chancery, exchequer, and chief habitation of the lord

1091. were at Cardiff, but he held besides, the castles of Kenfiggs and Cowbridge.

Among the lordships into which the country was divided, we find Senghennyth enumerated as having fallen to the share of Einon, whose name, however, does not again occur.

In 1174, we find Griffith ap Ivor ap Meyric, of Senghennyth,

1174. Arch. II. 2. doing homage, with other Welsh nobles, to king Henry II. at Gloucester; and it seems probable that this Griffith was

Girald. Camb. Cur. R. Hoare. identical with Griffith ap Rhys, called by Sir R. Hoare the descendant of Einon, and who was besieged in the Castell Côch, by De Clare, earl of Gloucester, and his eyes, with those of his children, put out, previous to their being starved to death, an act well worthy of Norman tyranny.

This Griffith was the last Welsh lord of Senghennyth. A building called Castell Côch, (the Red Castle) though probably erected by De Clare, on the scite of the older structure, soon after this transaction, still remains. It was so styled in contradistinction from Caerphilly, which was called the "Blue Castle."

1200. From the offspring of Fitz-hamon, who, it is probable, became possessed of it by conquest, the lordship passed through several generations to the De Clares, who came into possession about the commencement of the twelfth century.

1217. H. III. In this year, Reynold Braose, descended from Bernard Newmarch, the conqueror of Brecknock, made peace with his father-in-law, Llewelyn ap Jorworth, prince of Wales, and receiving from him the castle of Senghennyth, committed it to the charge of Rhys Vachan. This man, however, seems to have proved a false seneschal, for we find him soon afterwards driving out the Normans, *rasing Senghennyth* and the castles entrusted to his care, and dividing the lands among his Welsh countrymen.

Jones, H. of Brec. II. 330. About this time also, John Giffard le Rych, issue of John Giffard, of Brunsfield, by his third wife, Margaret Nevile, received the custody of Dryslwyn castle, Caermarthen, as well as the castle of Glamorgan and Morgannwc, which, as it can be shewn not to have been Cardiff, has been conjectured to be Caerphilly. It may be observed also, that a John Gifford is mentioned in the next reign as having, with Edmund Mortimer, slain Llewelyn, prince of Wales, and sent his head to the king.

Camden. Walsingham.

1221. The castle of Senghennyth was again fortified by John de Braose, in 1221, with the consent of prince Llewelyn.

1270. Beauties. About this time, Llewelyn ap Griffith is said to have taken the castle of Caerphilly, and after his death it was purchased by Gilbert, earl of Clare, whose widow remarrying, passed it subsequently to Ralph de Mortimer and his heirs.*

1276. E. I. Sir R. Hoare. Before the reign of Edward the first, there is no evidence of the occurrence of the name of Caerphilly; nor is there tangible proof of the existence of any strong hold in Wales, in the construction of which any great architectural skill was displayed, excepting only those which had been erected by the Norman invaders. Edward, who

* It is much to be lamented that there are no original authorities cited, in the full and apparently very accurate account of Caerphilly and its siege, given in the volume of the Beauties of England and Wales relating to Glamorgan.

during his absence in the east, enjoyed equal opportunities with his predecessors for the study of architectural display, possessed, after his return, the additional advantage of a long and vigorous reign, wherein to carry his knowledge into practice at home.

Lampeder Vawr, (1282,) and Beaumaris, (1295,) castles, were erected by Edward, to defend his new conquests and to bridle the Welsh. Llewelyn their prince had been put to death, and after the birth of Edward of Caernarvon, and his investiture with the Principality, or rather, with the earldoms of Chester and Flint, it is stated by the English writers, that the natives began to amass money and goods, and to live after the Norman manner, and to abide by the English laws.

In this year, Edward marched from Snowdon to Glamorgan,
1285. and having been received by the earl of Gloucester with great
Walsingham. honour, was by him, at his own proper charges, conducted to the Gloucestershire border, whence he proceeded to Bristol. The king was probably entertained at Cardiff, which, for the reasons which we have stated above, was the ordinary residence of the lords of Glamorgan,

During Edward's absence in Palestine, the Welsh, whose
1289. inherent love of liberty, even his crafty and cruel measures had been unable to quell, again broke out; and at a later period,
1295. under Mailgon, actually drove out Gilbert, earl of Gloucester, who had inherited Glamorgan, and who seems to have died about this period. The king, however, entering Wales, speedily reduced the Welshmen to obedience; and the three daughters of the earl of Gloucester, and his son Gilbert, a minor, were reinstated in their father's possessions.

Upon the accession of Edward II. he took advantage of the minority of the young earl of Gloucester, to give his sister away in mar-
1311. riage to his despicable favourite, Gaveston, a proceeding which gave great offence to the nobility of the realm, as well as to the earl her brother. Upon his death, while fighting against the Scotch,
1313. a few years afterwards, his vast estates were divided by the king among his three sisters, of whom the eldest was married to Hugh le Despencer—a name, if possible, more infamous than that of Gaveston.

Before the royal division of earl Gilbert's estates, which
Fœdera. being held in capite, were in the custody of the crown, we find a commission issued to Humfrey de Bohun to defend Glamor-
Feb. 1316. gan against the Welsh, under Llewelyn Bren,* who had risen

* Llewelyn Bren, grandson to Ifor lord of Senghennydd, at the time of the Norman spoliation, seems to have thought the contests subsequent on the failure of the male line of the De Clares, a favourable opportunity for regaining his ancestorial territories, and accordingly he invaded Senghennydd with ten thousand men, and assaulted and took Caerphilly Castle. This insurrection appears to have been soon suppressed, for Ifor and his sons Gryffydd and Jevan were imprisoned in the tower of London, in 1317.—*Beauties*, p. 583.

and invaded the lordship. Similar commissions were also issued to nobles in the neighbourhood.

In the tripartite division of the estates, Le Despencer having obtained the county of Glamorgan, we find him rated among the Welsh levies, at five hundred foot for his lands in Glamorgan and Morgannwc, and three hundred for the king's lands in his custody.

About this time also, Le Despencer took advantage of Mortimer's attainder to seize upon the castle of Caerphilly, which has been mentioned as descending to the Mortimers by the widow of an earl of Gloucester; and having fortified it by additional defences, was enabled for some time to withstand the forces brought against him by the incensed barons, although they finally obtained possession of it.

1321. By a series of acts of oppression in Wales and elsewhere, Hugh Le Despencer, and Hugh his son, arrayed the whole realm in arms against themselves and their monarch, and raised that fearful storm which involved them all in a common destruction.

1326. 20 E. IIII. In 1326, the queen and her paramour Mortimer, having taken up arms, the king, attended by the Despencers and Baldock the chancellor, fled from London, to which he never returned.

As the flight of the king from his barons and remorseless queen has, in its details, been generally neglected by historians, it may be useful to give the following rather minute particulars, compiled chiefly from, or at least corrected by, writs issued by the monarch on his passage.

Fœdera in loco. The king was at Westminster on the second of October, and at Acton on the same day. On the tenth, with a few followers, pursued by his queen with a much larger number, he rested at Gloucester, whence the elder Despencer, then ninety years old, was dispatched to defend the castle of Bristol.* From Gloucester, the king, accompanied by the younger Despencer and Robt. Baldock his chancellor, proceeded to Tintern, where he rested upon the 14th and 15th, and then remained at Striguil until the 21st. He was at Cardiff during the 27th and 28th, whence, probably deeming himself unsafe, he returned to Caerphilly, where he issued writs, bearing date the 29th and 30th of the month, to Rhese ap Griffith and others, giving them power to raise troops: Rhese seems to have been perfectly in the royal confidence, as his commission is unlimited.

Whether Edward thought Caerphilly too near the English border, or whether the garrison was too small to defend its extensive outworks, does not appear; but leaving Despencer to defend the castle, he retired to Margam, where he was on the 4th of November, and thence to Neath, where he rested the next day, and whence he issued a safe conduct to the abbot of that monastery, as his ambassador to the queen and Mortimer.

* Walsingham says that the elder Despencer was dismissed from Striguil.

Here he was joined by Despencer, who having surrendered Caerphilly to the queen and prince Edward, upon assurance of life, limb, and the oblivion of all things wherefore he was besieged in that castle, had been permitted to make his escape.

As Edward is only certainly known to have been at Caerphilly on the 30th, and at Margam on the 4th, there remains an interval of not more than four whole days, and possibly a portion of two others, during which his wanderings are unrecorded. If we suppose that he employed the interval in proceeding by sea to Margam, taking water at Cardiff or some neighbouring port, we shall be able to reconcile the narrative of Walsingham with that given above. Walsingham, whose information, though generally correct, is not always minute, makes him take water from Striguil. It seems, however, more probable that he went first to Caerphilly.

Froissart says that the king and Despencer, jun., held the castle, and Despencer, sen., and the earl of Arundel, the town, of Bristol, against the queen's forces; and that the two latter were executed under the walls of that castle, within sight of the king and all within it. He also relates that the king and Despencer, jun., were taken on the seas while escaping from Bristol, and brought back thither: points in which he is not borne out by any other contemporary writer, (within the circle of my reading). Froissart was clearly never in that part of England, and seems to have been misinformed. Fabyan merely gives a very general statement, agreeing, as far as it goes, with Froissart.

The king, Despencer, and Baldock, remained at Neath until the 10th, when Henry earl of Lancaster, Master ap Howell, (afterwards justiciary of Wales) and William La Zouch, having lands and power in the neighbourhood, were sent to watch the king, who finally, with his two minions, was seized near the castle of Llantursan.* The next writ is dated Ledbury, 13th of November, and finally the king was conveyed to Kenilworth, on the 14th of December.

Baldock, being an ecclesiastic, was confined to Newgate, where he died within the year; and Despencer, being hanged at Hereford, as his father before him had been at Bristol, his honours became extinct, and his estates reverted to the crown. He left, however, a widow, Eleanor, who stood in the relationship of cousin to the king.

I. E. III. Knyghton.

At the coronation of the new monarch, we find mentioned among the nobles present, Hugh Le Despencer, who seems to have been the eldest son of Le Despencer, and who died finally without issue. "He delivered up," says Knyghton, "the castle of Caerphilly, which he had from his father, to the king, and placed himself at his disposal, who in return granted unto him safety of life and limb."

In addition to this, the monarch seems to have regranted to him a

* Llantrissent.

Fœdera. XV. E. III. portion of his paternal estates, since we find him ordered to raise three hundred and thirty-two men in Glamorgan and Morgannwc, as his share of a Welsh army; and again, five years afterwards, he is rated at three hundred.

XX. E. III.

1329. The castle of Caerphilly does not, however, appear to have been restored to him, or to his mother; for we find a writ directed to Roger Mortimer, justiciary of Wales, "seeing that divers evil doers, abetted by William La Zouch De Mortimer, have beleaguered the castle of Caerphilly in warlike fashion, and held that leaguer in breach of the peace, and terror of liege subjects;" he is ordered "to raise the siege, (taking the posse if necessary) and to seize the castle for the king, and safely to keep it, arresting the recusants, if any, and committing them to prison." Also, on the same day, was issued a second writ, stating that William La Zouch De Mortimer had been summoned to appear in person, and had refused; refusing also to bring with him the king's cousin, Eleanor Le Despencer, residing in her country, and ordering "John De Gynes to attack him, and to bring both to the king."

A month afterwards, the writ to Roger Mortimer is repeated, expressing surprise at his delay in executing the first, forbidding any supplies of food to be admitted to the besieged, and commanding that restitution be made of the goods and chattels seized by La Zouch from John De Gray, the king's faithful subject.

From hence it would appear that William had already taken the castle, though the results of the royal writs are not mentioned.

Shortly afterwards, William and the king's cousin, Eleanor, were married.

1365. The castle was probably regranted by the king, with their titles, to the Despencers, for the widow of Edward lord Le Despencer, who died 1365, (49 E. III.) had the castle and town of Caerphilly, and the territory of Senghennyth, as a part of her dowry.*

1403. H. V. After the battle of Shrewsbury, and Henry's subsequent campaign in the north, that monarch directed the Welsh castles to be put in order, with a view to the final suppression of Owen Glendwr and his adherents. A writ, cited by Thomas, (Memoirs of Owen Glendwr, 1822, p. 120) commits the custody of Caerphilly and Gwyr-lacy to Constantia lady Le Despencer. Where Gwyrlacy was, is not now known; but it is singular that in this writ, which enumerates the principal fortresses in Wales, the name of Cardiff does not occur.

It was the above "Constantia" the widow of lord Le Despencer, and sister to the duke of York, who, a short time afterwards, attempted to rescue the young earl of March and his brother from the power of Henry IV. for which offence she was imprisoned.

* Owen Glendwr, in his invasion of South Wales in 1400, is said to have taken and garrisoned Caerphilly.—*Beauties.*

I have been able to find no further mention of Caerphilly until the time of Leland, who thus describes it in his Itinerary: "In Iscaibac is Cairfilly Castelle sette amonge marisches, wher be ruinous walles of a wonderful thickness and tower kept up for prisoners as to the chief hold of Senghenith."

Leland, VII. 39.

Our typographical arrangements do not admit of the insertion, in the usual manner, of the pedigree, shewing the descent of Caerphilly; we shall endeavour, however, thus to supply its place :—

1. Robert Fitz-hamon left a daughter and heiress, **2**. Maud, who married Robert earl of Gloucester, natural son to Henry II. and left **3**. William, 1173, married Hawisia, daughter to the earl of Leicester. **4**. They left four children. 1. Robert, who died without issue; 2. Isabel, married John earl of Oxford and Lancaster, afterwards king, for his first wife; 3. Amicia married Sir Richard de Clare, earl of Clare and earl of Gloucester in her right; 4. Mabel married the earl of Eureux. The earldom, the west of of England and the Welsh estates, centered in Amicia, who had issue, **5**. Gilbert de Clare, fourth earl, from whom sprung, **6**. Richard de Clare, fifth earl, Thomas his brother, and Margaret. **7**. Gilbert, the sixth earl, son of Richard, had issue, **8**. Gilbert de Clare, seventh earl, married Joan of Acre or Acon, daughter of Edward I. They left, **9**. four children. 1. Gilbert, eighth earl of Gloucester, slain at Bannockburn, (7 E. II.) without issue. 2. Eleanora, married, first, Hugh Le Despencer, jun., in her right, ninth earl of Gloucester, and governor for the king, of Caerphilly; and secondly, William La Zouch, of Mortimer. 3. Margaret married, first, Hugh de Audley, afterwards tenth earl of Gloucester, 1347; and secondly, Piers Gaveston: she had issue by the first marriage. 4. Elizabeth, foundress of Clare Hall, Cambridge: she married, first, John de Burgh; secondly, Theobald de Verdon; and thirdly, Sir Roger D'Armory.

The Welsh estates descended with Eleanora, who was kept prisoner in the Tower, with her family, until 5th Feb. (2 E III.); she left two sons, **10**. 1. Hugh Spenser, lord of Glamorgan, 1348, married Elizabeth, daughter of Hugh Montacute, earl of Salisbury. 2. Sir Edward Spenser, married Anne, daughter of Henry lord Ferrers, of Groby, and had issue, **11**. four sons. 1. Edward. 2. Thomas. 3. Gilbert. 4. Henry, the warlike bishop of Norwich. Edward lord Spenser, K. G., married Elizabeth, daughter of Bartholomew de Burglersh, and died at Cardiff: he had issue, **12**. Thomas lord Spenser, (1400) to whom the earldom of Gloucester seems to have been restored, but who was beheaded for treason, and forfeited his estates, (1 H. IV.). He married Constance, daughter of Edmund duke of York, and had issue, **13**. 1. Richard earl of Gloucester, (1414.) 2. Isabella, on her brother's death, heiress: she married, first, Richard Beauchamp earl of Worcester, and had issue, Elizabeth; and secondly, Richard Beauchamp, earl of Warwick, and by the latter had issue, **14**. Henry Beauchamp, duke of Warwick; and Anne, who

married Richard Neville, earl of Salisbury and Warwick, and left, **15**. three daughters. 1. Isabel, married George duke of Clarence; 2. Mary, 3. Ann, who married, first, Edward prince of Wales; and secondly. Richard duke of Gloucester, afterward Richard III.

Upon Richard's death, the estates passed to Henry VII. by whom the lordship of Glamorgan was granted to **1**. William, first earl of Pembroke, whose son, **2**. Sir Richard Herbert, 1460, married Margaret Craddock, and had issue, **3**. Sir William, baron Herbert of Cardiff, 1569, who married, first, Ann, sister to the marquis of Northampton; and secondly, Ann, daughter of the earl of Shrewsbury, and by her had issue, **4**. Henry, second baron—died 1601; having married for his third wife, Mary, daughter of Sir Henry Sidney, and leaving by her, **5**. 1. William, third baron, 1630, married Mary, daughter of the earl of Shrewsbury, and had issue, Henry, who died young. 2. Philip, fourth baron, who left issue by Susan, daughter of Edward earl of Oxford, **6**. Philip, fifth baron, who married, first, Penelope, daughter of Sir Richard Naunton, and had issue, **7**. William, sixth barron; and secondly, Catherine, daughter of Sir William Villiers; and had issue, **8**. 1. Philip, seventh baron, 1683, who married Henriette de Querouaille; and 2. Thomas, eighth baron. Philip, seventh baron, left issue, **9**. Charlotte, heiress of Usk Castle, who married, first, John lord Jefferies, 1702, and left Henriette, who married the earl of Pomfret; and secondly, Thomas viscount Windsor, baron Mountjoy, 1738, and by him had issue, **10**. Herbert, viscount Windsor, &c. who married Alice, daughter of Sir John Clavering; and had issue, **11**. 1. Charlotte Jane, who married John marquis of Bute, baron Cardiff, &c.; and 2. Alice-Elizabeth, who married the marquis of Hertford. Charlotte Jane had issue, **12**. John lord Mountstuart, who married Elizabeth Penelope, daughter and heiress of Patrick earl of Dumfries, and left issue, **13**. the present marquis of Bute, the possessor of Caerphilly Castle, and lord James Stuart.

(To be Continued.)

REVIEW.

A Historical and Descriptive Catalogue of the European and Asiatic MSS. of the late Dr. A. Clarke, by J. B. B. Clarke, of Trin. Coll. Camb. 8*vo. pp.* 236. London, J. Murray.

This volume is a catalogue raisonnée of Dr. A. Clarke's MSS. by his son. Such books are ordinarily attractive to none but a collector, and present little to interest or instruct other readers. The volume before us is, however, of a somewhat superior cast. To the title of each MS. is appended a short, and often very curious, account of its history; and scattered through the work are several lithographs of capital letters, etc.,

tastefully selected, and well executed. To the titles of many of the MSS. are also added quotations from their contents: thus a poem, p. 70. entitled "The goode Wif thaught hir doughter fele time and often gode woman for to be," commences,

"Doughter, gif thou wilt ben a Wif & wiseliche werch,
Loke that thou love well god & holy cherch;
Go to cherch when thou mygth, lette for no reyn;
All the day thou farest the bette that thou hast god yseyn.
Well thryueth that god loveth, my dere childe."

From the end of John Wesley's journal and account-book, we extract the following entry:

"N. B. For upwards of eighty-six years I have kept my accounts exactly: I will not attempt it any longer, being satisfied with the continual conviction that I save all I can, and give all I can, that is all I have. JOHN WESLEY."

Prefixed to the catalogue of the Hebrew MSS. is a very curious account of the Jewish method of preparing the parchment, making the ink, forming the letters, stitching the sheets together, and destroying, by burial, the old MSS.; together with a number of other similar observances, all placed under the sanction of the Jewish religion.

The catalogue of the oriental MSS. occupies the latter half of the volume, and the translations given from the Persian poets, evidently executed with much of the spirit of the original, are exquisitely beautiful: take the following for instance, the "Prayer of Khosroo," p. 142, by that accomplished Orientalist, the late C. Fox, of Bristol, which, as a devotional hymn, has rarely been surpassed.

"Father of those, who yet on Earth
Pursue their toilsome way,
Support of all things here below,
Whom all in Heaven obey:

How boundless thy beneficence,
Which liberally imparts
Joy to the wretched who rely
On thee with faithful hearts!

And all mankind who humbly ask
Of Thee, in fervent prayer,
Forgiveness of their numerous sins,
Shall all thy mercy share.

* * *

One drop of water from the Fount
Of thine eternal Love,
From the dark Record of our sins
Can all their sum remove.

* * *

Khosroo, who chief of sinners mourns
His weakness in the dust,
Can he e'er hope his lot may be
Associate with the Just?

Ah! heavenly Lord, I pray thee deign
To hear thy suppliant's call!
Thou art my everlasting God,
Thou art the God of all.—C. Fox."

The typography of this volume is excellent, and does credit to the Frome press.

Mr. Clarke, speaking of the MSS., thus concludes his preface: "It is possible that the following three united circumstances may shortly separate them and their present owner,—a want of time to use them, an inability to *increase* them, and my being apparently born only to occupy heavy curacies." A valuable piece of preferment has just been creditably bestowed upon the son and biographer of CRABBE; let us hope that a similar reward may be the lot of the son and biographer of CLARKE; who, if not like Mr. Crabbe, a poet and a minister of the Church of England, was certainly not less illustrious than he, as a benefactor to his country, and a minister of the Church of Christ.

Russia; or, Miscellaneous Observations on the Past and Present State of that Country and its Inhabitants. By R. Pinkerton, D. D. 1833, 8*vo. pp.* 486.

WITH the empire of Russia, that is, with its physical constitution and boundaries, with the numerous tribes and nations that inhabit it, with their manners, customs, state of civilisation, and religious observances, the English public are, in proportion to the importance of the subject, but little acquainted.

Dr. Pinkerton, already respectably known by his work upon the present state of the Greek church in Russia, and by the important reports which he has from time to time transmitted home during his protracted residence in that country, was admirably calculated, from his knowledge of the people and their languages, from the activity of his habits, and from his perfect freedom from all party or political prejudices, to make important additions to our stock of knowledge upon almost every department of Russian policy and œconomy. It is to fulfil such desiderata, that a part of his present volume has been written; it is in size a thick 8vo. decorated with some very well executed plates of costumes; and it is, as its title states, of a very miscellaneous character.

Since the reign of Peter the Great, the attention of the Russian government has been closely directed to the numerous and dissimilar tribes by whom the empire is peopled, and to the condition and capabilities of the territory itself, for the support of a vast and increasing population.

The tribes of Finnish, Danish, or Sarmatian origin, still retain many of their original peculiarities, although the influence of a regular government has rubbed off some of the most offensive, and is daily smoothing down the asperities of dialect, and melting into one homogeneous mass the less important distinctions of dress and habit.

The territories of Russia have been estimated at 340,000 German square miles, and its population, according to the latest census, at nearly thirty-eight millions. The towns of the empire are six hundred and thirty-four in number, of which the principal ones contain upwards of thirty thousand inhabitants. One half of European Russia is said still to be occupied by forests.

The staple of Russian export trade is timber and its products, as pitch, tar, turpentine, etc. There are also to be found manufactories of silk, linen, glass, leather, rope, etc., all more or less active; for the most part, however, lodged, not in the hands of a regular manufacturing class, but belonging to great nobles; as was, to a certain degree, the case in this country, until monopolies were overthrown by an act of the legislature. The articles of Russian manufacture are not, excepting glass, equal to those of foreign countries, which are accordingly preferred in almost every case by the people.

Russia carries on a trade with Persia by the Caspian, chiefly through the emporium of Astracan, with China and central Asia, and by way of the rising port of Odessa with the nations round the Black Sea. Her trade with Turkey is considerable; in Europe she traffics with Hungary and Prussia, and above all, with the nations of the Baltic and the British isles.

Russia, both as regards territory and population, has not yet reached that point of civilisation which will enable her to concentrate her efforts for the accomplishment of any given object, but she is approaching it rapidly; and it becomes therefore a question of near and vital importance, not only to herself, but to the two great quarters of the globe which she unites, that her civilisation should be accompanied by sound education,—her augmenting power with the capability of using it rightly.

The moral and intellectual condition of the Russian people becomes then a question in which this country, as the great naval power, and in many other capacities, is right nearly concerned; and it is by the explication of this question that the volume of Dr. P. is mainly occupied, and to the furtherance of which his energies have been, and we believe still are, devoted.

Civilisation, in the modern acceptation of the term, implies education, and education religious instruction, for the development of the mental powers, without a corresponding advance of the sense of a strict responsibility attending upon their use, would be what none but a madman would desire. Civilisation, however, does not necessarily imply luxury, for though in this country they are found in close alliance, yet the experience of Germany, Prussia, Scotland, and some parts of Switzerland, plainly shews

that they may be separated; and that although, perhaps, at some period or other, luxury will follow civilisation, yet that it does *follow* it, and that often at a very, very considerable distance.

Civilisation, in its best and broadest sense, is "a gradual advance of the minds and manners of a people, from a state of ignorance and indolence, to a state of *knowledge* and industry, in all their various ramifications." Such a work must therefore be gradual,—the causes producing it must be incessant,—their operation must be universal. In Russia the latter of these rules has been neglected, and the consequence has been, that the nobility and merchants are only partially civilised, because the lower classes are scarcely civilised at all.

It is said, by those who have studied the Russian character, that its type is a high one, and that there are visible indications of vigour and ability, not inferior to those of any nation.

The great evidence of the gross superstition which has clogged intellectual improvement in Russia, is to be found in the errors of her church, which, holding doctrines approaching much nearer to her Reformed than to her Roman Catholic brethren, is in practice very low indeed. The great superstition of the land is image worship. The people have confounded the image with that which it was intended only to represent;—and what did the early idolaters do more?

Dr. Pinkerton has devoted a chapter (by far the most interesting in his book), to the personal character of the emperor Alexander, who, according to the accounts given of him from all quarters, seems to have been one of the best, and in some points, one of the ablest monarchs who ever filled a throne. The temperate decision of his sway, rendered still more popular by the suavity of his manner, and the mild spirit of his acts, caused him to be adored by the inhabitants of his vast empire; and have left impressions in favour of unlimited despotism, which all the follies and severities of his successors have not been able to wipe entirely away. The Russian peasant, though superstitious, is still sincere, (p. 335,) and though brave and independent, still loyal, (p. 315;) but with much that is bright and honourable, there is also in the Russian character more that is dark and disgraceful. We have purposely abstained from quotations, to make room for the following:—(p. 327.)

"Men's characters are formed by their education, and by the circumstances in which they are placed: and where a nation is distinguished by civil freedom, and a steady government according to equitable laws, combined with genuine Christian principle and general knowledge, the characteristics of the people will be more or less in harmony with these advantages; they will be found candid in their statements, honourable in their transactions, polite in their manners, and humane in their treatment of enemies. But the history of all nations teaches, that where despotism, oppression, intrigue, and injustice, either sit upon or surround the throne, and occupy the seats of rule and all offices below it, the character of the people is equally moulded according to these evil qualities: cunning and deception take the place of candour

and justice; haughtiness and meanness are found to exist in the same individual, according to circumstances; and the man who has often suffered unjust and cruel treatment at the hand of others, becomes unjust and cruel in his turn. Nothing but vital Christian principle will enable a man to return good for evil. If this, then, be a just view of human nature, we are not to look for high principles of honour where rational freedom is not enjoyed, where national laws and institutions do not guarantee equal justice to all, where despotic power descends from the throne to every one who occupies a place below it, and where the weight of oppression, under which the injured suffer, is too often augmented by the very attempt to obtain redress."

POETRY.

IMITATION OF COWPER.

Winter with all his frowns has fled once more;
Joyous I hail the joyous vernal day,
When all the air seems saturate with light,
And on the universal face of things
A sparkling brilliance rests, flung gaily back
From many a quivering leaf's transparent green,
And many an insect's brightly burnished wing.
The temperate breeze that wafts its freshness round,
Fraught with the sweetness of the full blown spring,
Conveys to every thing that lives new life,
New vigour:—simply to draw breath becomes
A most voluptuous act—all being shares
A general jubilee—from all goes forth
The general voice of joy: there chiefly heard,
And there most tuneful, where the wood's thick shade
Shelters the lovely warblers of the sky:
Almost the aching head and sorrowing heart
Yield to the influence of the time; almost—
And for a moment, cast the burthens off
That weigh them down.—So nature's radiance throws
One gleam of sunshine on the gloomy soul.
For it seems impious coldly to reject
The joys that heaven so lavishly provides;
Joys that refine the soul—oh how unlike
The feverish pains, man for himself invents
And miscalls pleasures—pleasures whose first taste
Is after bitterness; whose very act
Palls on enjoyment, which to memory leave
A weight, a sting, a curse; but fearless here
In nature's rich variety we feast—
Enjoy the gift—and the All-giver bless.—W. D. C.

J. CHILCOTT, PRINTER, WINE STREET, BRISTOL.

ERRATA.

Page 90, line 10 from bottom, after *be* insert *go*.
,, 96, line 11, dele *one of*.
,, — line 25, after *Geologists* insert *a full stop*.
,, — line 26, after *ray*, insert *a comma*.

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PART II.—LITERATURE.

ESSAY ON THE WRITINGS OF HESIOD,

PRINCIPALLY COMPILED FROM SOME MS. LECTURES DELIVERED AT OXFORD BY THE REV. J. J. CONYBEARE, PROFESSOR OF POETRY.

Communicated by his brother, the Rev. W. D. Conybeare.

ON THE THEOGONY.

(Continued from p. 47.)

We now proceed to the body of the work. Hesiod assumes as the universal origin of things, the "rude and undigested mass" of chaos, like all the other ancient writers of Cosmogony who, as we have already said, had (with the single exception of the inspired author of Genesis,) no idea of any proper creation of matter itself. The first series of divine, or rather physical principles emanating from, or rather perhaps coexistent with Chaos, is then enumerated thus,—the Earth, Tartarus, and Love.* From Chaos sprung Night and Erebus, and Night in turn gave birth to Æther and Day. In most of these allegorical personifications we observe the mere images of natural and sensible objects. Love, as among the primal causes of things, must be here understood in the philosophical sense of the great principle of union among things, whether animate or inanimate, and

* In a well-known passage in the birds of Aristophanes, l. 694, is a sketch of a somewhat similar cosmogony; but here Chaos, Night, Erebus, and Tartarus, are the primeval principles. Night brings forth an egg, whence Love appears, who mingles the elements and produces Heaven and Earth. The Phœnician cosmogony, as delivered by Philo Byblius, very nearly resembles this passage of Aristophanes. Homer might appear to have had a different Theogony, for (Il. E. 200.) he makes Ocean the father and Thetys the mother of the gods; but perhaps he is here only speaking of the Oceanides.

the general exciting cause of being : *'η κινητικη και συναγωγος των οντων αιτια* ; yet the attributes here ascribed to it by the poet, are rather those of animal passion.

From Earth alone, *ατερ φιλοτητος εφιμερου*, sprung the co-equal Heaven, the Mountains, and the Sea; but the same universal mother, taking to herself her first offspring, the Heaven, as an husband, gave birth to a numerous progeny.* We may be surprised to find the Ocean reckoned first among these, as we have before seen the sea, *Ποντος*, specified as the offspring of Earth alone, without a sire. But we may perhaps explain this seeming inconsistency, by considering the poet, or rather, the original inventors of this cosmogony to have conceived that the Earth required nothing but her own energies to produce those inequalities of surface which, by their elevations, constitute the mountains, and by their depressions the basins of the inland seas. But the vast circumambient expanse of ocean stretched to the horizon, and blended as it were with the heaven, might seem to depend on the conjoint influences of Heaven and Earth. The rest of the offspring of Heaven and Earth are of very obscure character: the scholiast, indeed, refers them all to physical allegories; but his arguments are mere conjectural etymologies, which it may perhaps be fair to mention in passing on, but to which we can attach no manner of weight. It seems far the most probable view of the matter, that physical allegory had already, in the age of Hesiod, become inextricably blended with fabulous mythology. Two of this progeny, Hyperion and Phœbe, the general usage of Homer and most other poets would incline us to interpret as the Sun and the Moon; but as these luminaries are expressly mentioned in a subsequent passage of the present poem as the children of Hyperion, we must either find some other explanation of the terms in this place, or conclude that such an inconsistency must demonstrate the conflicting passages to have been originally fragments of distinct poems, jumbled together by the rhapsodists. On the former hypothesis, we might, with the scholiast, explain Hyperion, "the mover on high," to denote the primum mobile of the celestial revolutions; and Phœbe as the radiant æther, or perhaps elemental light. Themis and Mnemosyne, Law and Memory, seem personifications too obvious to be forced into any series of purely Physical causes. The remaining Titan brethren, (for we must observe that Titans is the proper

* One of the principal subsidia which we possess for comparing the following genealogies, whenever we may suspect interpolation or omission, will be found in the Bibliotheca of Mythological Histories, compiled by Apollodorus, an Athenian grammarian, who flourished 104 years before our æra. The observations appended to the edition of Heyne, 1803, are particularly valuable. In the third book of Diodorus Siculus, we find several chapters bearing on this descent of the gods from Earth and Heaven; but in these, the systems which he professes to have derived from the Atlantic nations, from the Phrygians, and from the Egyptians, are somewhat confusedly intermingled, and they will rather perplex than assist us.

common appellation of these children of Heaven and Earth,) Coeus, Κοιος, Æolicè pro Ποιος, Quality: Crius, Κρειος, from the obsolete κρεω, the root of κρατος, Power: Iapetus,* from πιπτειν ανω, the upper regions, because light things fall upwards, (this is the most forced and unnatural of all these etymologies). Thia, Θεια, from θεασθαι, to see, the faculty of sight, she is afterwards represented as the mother, as Hyperion, the high mover, is the father of the sun and moon. Rhea, Ῥεια, from ρεειν to flow; Rhea is said to have been the wife of Kronus, or Saturn, Κρονος, for χρονος, the representative of time, because time perpetually flows; Rhea is also sometimes taken as a title of the Earth, because the rivers flow thence; but we have already seen that Hesiod makes the Earth, an older goddess, the mother of Rhea. It seems necessary in our remarks on this poem to mention these speculations of the ancient commentators, but surely to mention them is to expose their utter uncertainty: the marine goddess, Tethys, is also here mentioned. We now come to the most distinguished, though one of the youngest, of the Titans, Kronus, or, as named by the Romans, Saturn, whose farther legend we shall soon have occasion to notice. That this deity is truly, as has been said above, a personification of time, seems clearly established by the general consent of antiquity, and by the nature of the obviously allegorical attributes assigned to him,† he is called the

* Iapetus, the father of Prometheus, who was said to have formed from earth and water the human race, hence called, audax Iapeti genus, is by many supposed to have been taken from a corrupted tradition of Noah's son Japheth, the presumed ancestor of the European population. Such a tradition may easily have exalted the head of their own race to the station of the general head of the whole species.

† That Time (if this explanation be correct) should be thus represented as one of the *youngest* of the offspring of Heaven, is a remarkable instance of the gross inconsistency of this system; for as Time must metaphysically have originated from the very earliest moment when the operations of nature commenced, he ought undoubtedly to have been the firstborn of these emblems of those operations. Plato, in the Timœus, goes still further, and makes Saturn the grandson instead of the son of Heaven and Earth; his immediate parents being there represented as Ocean and Tethys. We are not well satisfied with any of the etymologies of the Roman Saturn; but there seems no doubt of his exact identity with the Greek Κρονος. Sir Wm. Jones mentions an Indian mythological personage, named Satya Vuater; but there seems little analogy between his story or attributes with those of Saturn, excepting that he gives name to one of the Indian periods, the Satyagus, nearly corresponding with the Saturnian age. It would be interesting to examine whether there be any mythological legends relating to Shunee, the god of the planet Saturn, and presiding over the same sixth day of the week: the Saxon deity of that day, Seater, approximates, at least in name. The Egyptians do not appear to have possessed an analogous deity, although Anubis is by Plutarch in some respects compared to him. The references before given to Philo Byblius, will shew how closely the Phœnician coincided with the Grecian system in every thing relating to this deity, that is, as to his parentage and his dethroning his father, Heaven. He repeatedly tells us that his Phœnician name was Israel, which we know means the powerful God in the Semitic languages, and that he had an only son, Ieud (Ihid in these dialects). Here the Grecian

youngest of the divine Titans. But his parents had two other sets of monstrous children, viz. 1. the three Cyclops, the artificers of the thunderbolt, named by titles which need no commentary, Brontè, Steropè, and Argò; Βροντη, Στεροπη, Αργη, (αργης κεραυνος); Thunder, Lightning, Rapidity. These have little, except their single eye, in common with Homer's Sicilian Cyclops, and both differ from the Cyclopian builders of Tiryus. 2. The three Centimani, or hundred-handed monsters, with fifty heads, Cottus, Briareus, and Gyges. The allegorizing scholiast transforms these into the three seasons of the year, taking Cottus as the heat of Summer; Briareus, from Βρυειν, as the Spring; and Gyges as the Winter. He does not inform us why the winter is to be omitted in this list of seasons: their multiplicity of heads and arms are said to denote their various energies.

Although these absurd attempts of the scholiasts to unravel this tangled skein of allegory, may well convince us of the utter futility of any endeavour to reduce the whole to any thing like a consistent scheme; still it will always remain evident that a considerable proportion of these deities are undoubted physical personifications; and therefore it seems almost demonstrable, that physical allegory did indeed form the original basis of the system, though that original basis was already, in the age of Hesiod, overlaid by much extraneous and incongruous addition, and the primary intention probably in most instances forgotten.

We now arrive at the first of those great revolutions, to which this system of mythology supposed the dynasties of Olympus to be no less liable than those of Earth; the son usually dethroning the father, so that it might be said of the inhabitants of Olympus, as of certain Asiatic tribes, that the grandfather loves his grandchildren, as seeing in them the enemies of his enemies. Heaven, we are told, abhorred his children, and hid them in the recesses of the Earth. Their mother, Earth, resenting his cruelty, endeavours to urge her offspring to revenge. Saturn alone is bold enough to listen to her counsels. The story of his mutilation of his father is well known, and probably veils, under somewhat coarse images, a physical allegory. From the drops of the wounded parent's blood which fell on the earth, sprang the Furies and the Giants; while under the influence of a similar cause, Venus arose from the foam of the sea.* We may quote Hesiod's description of this latter event, as a favourable specimen of his poetry.

departs from the Phœnician system. The Greek Jupiter was clearly borrowed from another source, probably Egyptian: this god was worshipped with human sacrifices in all the Phœnician countries. Diodorus Siculus especially describes his barbarous rites at Carthage, LXX. 756.

* The physical allegory contained in this legend appears to be very justly explained by Macrobius, in the first book of his Saturnalia, C. viii. Est idem Κρονος και Χρονος; hunc aiunt abscidisse Cœli patris pudenda; quibus in mare dejectis Venerem procreatam; quæ a spumâ unde coaluit, Αφροδιτη, nomen accepit. Ex quo intelligi volunt cùm chaos esset tempora non fuisse: si quidem tempus est certa dimensio,

Εκ δ' ἔβη αιδοίη καλὴ Θεός Αμφὶ δὲ ποίη
Ποσσὶν ὑπὸ ῥαδινοῖσιν ἀέξετο. * *
* * * * *
Τῇ δ' Ερος ὡμάρτησε, και Ιμερος ἕσπετο καλὸς
Γεινομενῃ τὰ πρῶτα, Θεῶν τ' ἐς φῦλον ἰόυσῃ.
Ταύτην δ ἐξ ἀρχῆς τιμην ἔχεν ἠδὲ λελογχε
Μοῖραν ανθρώποισι καὶ ἀθανάτοισι Θεοισι
Παρθενίους τ' ὄαρους, μειδήματά μειλιχίην τε.

Forth sprang the goddess, lovely as divine,
While round her gently-gliding footsteps swell'd
The light sea foam, as Love and fair Desire
Attend her progress to the heavenly choir.
Such honour on her waited from her birth;
And this her portion among gods and men,
The youthful converse, and the smiling glance,
And all the wiles of love and soft delight,
The fond caress, and honey'd blandishments.

The poet has thus far been occupied by his account of the Titan descendants of father Heaven and mother Earth. It may perhaps appear singular to us, that we find scarcely any of these retained among the principal gods, whose service is familiar to us from the classical writings; for from the peculiar circumstances of her birth, we can hardly reckon Venus among the number; and even Kronus, or Saturn, although well remembered as an object of mythological history, seems scarcely to have been honoured in Greece by any popular worship,* and does not stand in the

quæ ex cœli conversione colligitur: inde ab ipso natus putatur, Κρονος. Cùmque semina rerum omnium post cœlum gignendarum de cœlo fluerent: ubi mundus omnibus suis partibus perfectus est, certo jam tempore finis factus est procedendi de cœlo semina; ad æternum vero animalium propagationem in Venerem generandi facultas deinceps translata est.

We have before stated that the same fable of the mutilation of Heaven by Time is recorded by Philo Byblius to have formed a part of the Phœnician mythology. We do not remember any allusion to it in Homer, although he once or twice speaks of Kronus, with Iapetus and the other Titans, as expelled to Tartarus; but this is rather connected with the war of the Titans against Jupiter, which we shall hereafter have to consider. The Aphrodite of Homer is described as the daughter of Jupiter and Diana, and Apollodorus concurs in this genealogy. The epithet φιλομειδης (although accommodated by Hesiod, by the change of a single letter, to his own legend of her birth,) obviously throughout the Homeric poems simply signifies a lover of smiles. Wolf, however, considers the line in Hesiod, although referred to by Eustathius, as an interpolation. This mythus of the birth of Venus is, as far as we remember, peculiar to Hesiod.

* In all the Phœnician settlements, however, as at Carthage, he appears to have been retained as the principal god, and worshipped with human sacrifices. The Grecian system, which exalted Jupiter to the throne of Olympus, and was of an unbloody and mild character, seems to have superseded, at a later period, this barbarous form of early superstition. As the dethronement of Saturn by Jupiter, does not seem to involve any physical allegory, we may perhaps conjecture that it is merely a mythical mode of relating the manner in which an older form of idolatry was forced to

well-known list of the twelve principal deities. These, as we shall hereafter see, (with the single exception of Venus,) consist exclusively of the brethren or descendants of Jupiter, whom a subsequent Olympic revolution exalted to the throne of power. To these younger gods, therefore, (the Θεοι Νεωτεροι,) as the associates of this supreme head, we must regard the popular belief as having ascribed exclusive power to aid their votaries.

Hesiod proceeds in his Theogony for about three hundred lines, exhibiting little of poetical ornament, by enumerating several other genealogies; in the first place, of this primæval race of gods, and afterwards of their descendants in the next generation. Of the primæval race he specifies, first, the children of night; and secondly, another progeny of mother Earth, who, besides the offspring we have already considered by Heaven, had another race by the Sea (Pontus, as distinguished from Oceanus). We will speak of these in order.

1. *The offspring of Night* (line 211).* Night, as we have already seen in the very commencement of these genealogies, was represented as having borne to Erebus Æther and Day. Here the physical allegory is obvious; but in the present passage, Hesiod recounts a numerous progeny of the same mother, without a sire; and here the idea of night seems very variously and vaguely taken—sometimes in its ordinary sense, sometimes as the metaphysical notion of privation, and lastly, for any mysterious and fearful cause whatever. Thus Sleep, Dreams, and the Hesperides, who guarded their golden apples in the farthest isles of the west, are naturally connected with the physical ideas of Night. Destiny, ever shrouded in impenetrable gloom, may be considered as the appropriate offspring of Night; and accordingly Hesiod has so assigned it, under four different designations, Μορος and Κηρ, in the singular, and Μοιραι and Κηρες, (the Fates) in the plural;† including Clotho, Lachesis, and Atropos. To these also the unusual character of the avengers of transgression is here assigned, although Nemesis, the principle of divine vengeance, is likewise separately

succumb beneath the influence of one more modern. The newer gods, the Θεοι Νεωτεροι, would, on this system, be perfectly intelligible. In Rome, the very different character of some ancient local deity, Saturnus, the introducer of civilisation and agriculture, seems to have been strangely blended with these Phœniceo-Grecian fictions. And the memory of the Saturnian age of primitive innocence, equality, and liberality, was fondly cherished in the Saturnalia of December, when the slave was permitted to recline at his lord's table, and mutual presents, the origin of our own Christmas boxes, flew around. Kronus is also said to have had a temple and festival at Athens; and the people of Elis connected him with the origin of the Olympic games. Still, however, the assertion of the text, that he does not appear in these nations to have been the popular object of native prayers or sacrifices, will, we believe, be found perfectly just.

* According to the Scandinavian mythology of the Edda, Night had three husbands: among her children were the Earth and Day.

† This surely shews that fragments of at least two poems must here be jumbled together.

included in the list. Deceit and Love are somewhat strangely coupled together, among this progeny, in a line, (which is however suspected as an interpolation) for the dark falsehoods, sprung from Night, cannot surely be the mere wiles of coquetry. Reproach and misery, old age and death, are introduced as dark and sad privations. And lastly, Strife, has a similar moral character; of this last gloomy principle, Strife, all the fearful progeny are then recited, Labor, Oblivion, Famine, Woes, Battles and Slaughters, Wars and Homicides, Quarrels, Lies, Controversies, Anarchy, Injury, and Perjury.

2. *The offspring of Sea and Earth.* These were three sons, Nereus, Thaumas, and Phorcys; and two daughters, Ceto, (the wife of her brother Phorcys,) and Eurybia, the latter became the wife of Arius, one of the Titans. The descendants of the three sons are enumerated in the following lines, in an incongruous mixture of various mythical fictions, which, as Wolf well observes, can by no means be referred to a single mode of allegory, and scarcely to a single poet. Some, and these probably the most ancient, have a decidedly physical character; others are mythological fables, or perhaps perversions of history. Nereus espouses Doris, (line 233,) and from their union spring the vast family of Sea Nymphs or Nereids. It were equally uninteresting and uninstructive to repeat the names of some fifty here enumerated:* we need only observe, that they are all derivations from the natural features of the ocean or its shores, or compounds, like wave-receiving, wave-allaying, ocean-speeding, &c. One of them, φιλομειδης, smile-loving, may remind us of that lovely description in Æschylus:—

> Ποντιων τε κυματων Ανηριθμον γελασμα.
> The countless smiles that deck the rippling waves.

Thaumas (apparently so called from the wonders of the deep) espouses Electra, the daughter of Ocean, (line 266,) by whom he has Iris, the rainbow, and the two Harpies, from αρπαζειν, the blasts that snatch every thing before them; their names were, Aello, (stormy,) and Ocypetes (swift-flying):—here every thing is obviously physical. Phorcys marries his sister Ceto, (l. 270,); and the poet proceeds to enumerate their descendants to the fifth generation, forming as curious a collection of monsters

* Homer's Iliad, E. 39 to 49, gives us a list of thirty-three Nereids, concluding with, "and all the other Nereids." Two entire lines in the lists of Homer and Hesiod, are to a word the same, and a majority of the names agree; but some exhibit different readings, and some are quite different. One or two of Homer's Nereids are reckoned by Hesiod, in a subsequent list, among the daughters of Oceanus. Pindar, Isth. vi. 8. Euripides, Ion. 1081, and Iphig. in Taur. 274, and the authors of the Orphic Hymns, xxiii. 3. reckon fifty Nereids with Hesiod; but some other poets carry up the number to an hundred. The list in Apollodorus will afford some various readings; he omits many of Hesiod's Nereids, and inserts two or three of his Oceanides.

as any mythological menagerie can well present. They very appropriately form the subject of a chapter in the treatise of Palæphetus, the Greek mythologist, on "*Incredible Histories.*" In the first generation, the daughters of Phorcys were the two Graiæ, Pephredo and Enyo, (the same with Bellona,) and the three Gorgons, Stheino, Euryale, and Medusa. The latter became pregnant by Neptune; and some mythologists inform us, that Minerva, whose temple was then violated, being incensed, changed her before beautiful locks into twisted serpents: the mingled beauty and terror with which her head is represented in some ancient gems, is well known. The Gorgons inhabited the same isles of the extreme west with the Hesperides. When Medusa's head had been cut off by Perseus,* her posthumous offspring sprung forth—Chrysaor, and his steed Pegasus, mounted on which, and waving a golden sword in his hand, he flew, bearing thunder and lightning, to the palace of Jupiter, where he now dwells. Chrysaor

* Herodotus II. 91, informs us that the story of Perseus is of Egyptian origin, and imported into Greece by Danaus. In the city of Chemmis, in the Thebaid, he noticed a statue of Perseus, and says that the natives gave the same account as the Greeks, of his going to Africa to cut off the Gorgon's head. Homer mentions the Gorgon's head as an ornament carved on the Ægis of Jove and Minerva, and on the shield of Agamemnon; the scholiast on Homer, however, maintains that he only uses these terms as a personification of Terror, and that he was unacquainted with the fables of Perseus and the Gorgons. Pindar, however, alludes to it in the X. and XII. Pythian; and Æschylus, Prom. Vinet. 791, gives us the full vulgar tale, which represents the Graiæ as possessing between them only a single eye and tooth, which they borrowed from one another in turns; he calls them swan-formed. He adds that none could look on the serpent locks of their sisters, the Gorgons, and live. The well-known petrifying quality of Medusa's head is well adapted to a mythical personification of Terror, the probable origin of these fictions. One of the lost dramas of Æschylus, the Phorcides, entirely turned on this fable. Pherecydes, a mythological writer of the age of Pericles, related the whole adventures of Perseus; but he is only known as cited by later scholiasts. Apollodorus, apparently following these early authorities, has given us a complete Arabian tale on the subject; he makes Perseus, by stealing the single eye of the Graiæ, oblige them to direct him to the nymphs, from whom he obtains three wonderful gifts, the winged sandals, the helmet, which (like the northern cap of darkness) has the power of rendering the wearer invisible, and a magical satchel. Thus provided, he comes on the Gorgons while sleeping; and not daring to look directly on their petrifying faces, he guides his blows by the reflected image in his polished shield, and so cuts off Medusa's head, which, having first employed to petrify all his foes, he finally bestows on Minerva his great protectress. It is sufficiently amusing to observe the labours of some of the later mythologists, to turn these good stories into grave allegories. Hesiod, in the shield of Hercules, if that poem be really his, has described (l. 216) Perseus as sculptured in exact agreement with this story, the winged sandals on his feet, flying, like thought, with the terrible Gorgon's head enclosed in the satchel on his back, and the dread helm of Hades, invested with the gloom of night, pressing on his brows.

Diodorus Siculus, (l. 111,) turns the Gorgons into a nation of female warriors, like their neighbours, the Amazons, and says that Perseus subdued them in the reign of queen Medusa.

(l. 287,) married Callirhoe, a daughter of Ocean; their offspring (being the third generation of the descendants of Phorcys) were, the triple-headed Geryon, afterwards slain by Hercules; Echidna, half a black-eyed, fair-cheeked nymph, and half a serpent, vast and dread; she dwelt in a cave, in the mountains of Arimi, in Cilicia. Impregnated by the whirlwind Typhaon, Echidna became the mother of a large progeny of monsters—Orthrus, the dog of Geryon; the fifty-headed Cerberus, the dog of Pluto; the Lernæan Hydra, to vanquish which became one of the labours of Hercules; and the Chimæra, a strange compound of lion, dragon, and goat.* This Chimæra found a suitable mate in her brother, the dog Orthrus; and their progeny were such as might be expected from so well-assorted an union, the Sphinx, fatal to the race of Cadmus, and the Nemæan lion, the cause of another labour of Hercules, between whom and these great grandchildren of Phorcys, a death-feud appears to have prevailed. The poet has thus far traced the line of Phorcys and Ceto, through their daughter Medusa, for five generations; but at the close he returns back to inform us, that the same ancestors were likewise parents of the dragon, who from his den watches over the golden apples of the Hesperides. These wild mythological combinations seem very probably to be derived from the hieroglyphical representations of Egypt, to which country we know that the Sphinx, and the fable of Perseus, and the Gorgons, originally belonged.

Having thus traced the mythological descendants of the Sea and Earth, the poet returns to the family of the Titans, the offspring of the same mother by Heaven, the first generation of whom he had before recounted at the very head of his genealogies, viz. Oceanus, Hyperion, Crius, Cœus, Kronus, (or Saturn,) and Iapetus. He now proceeds to the second generation, the offspring of the above.

1. Oceanus espouses his sister, Tethys (l. 337). In the enumeration of this offspring, physical allegory again prevails for the principal rivers of Greece, and the western portion of Asia Minor, together with the Nile, the Eridanus, the Danube, Ἴστρος,† the Phasis, &c.—We may mention the above as shewing the extent of the poet's geographical knowledge, which, if it may be judged of from this evidence, must have been very limited; the mighty rivers of Mesopotamia, and a portion of those of India, appear

* Here two verses from the Homeric description of the Chimæra, Il. Z. 181, have become interpolated in the text of Hesiod, by the negligence of rhapsodists or transcribers. The two poets, however, somewhat differ, for Hesiod assigns the forms of the various animals to her three heads; Homer to her head, body, and tail.

† In this list we find the river of Egypt called the Nile, whereas Homer always names it Ægyptus: hence the scholiast has drawn an argument, that Hesiod must be the latest of these two poets. Homer never mentions the Danube, or Phasis. One of Hesiod's rivers, the Ardescus, said by the scholiast to be somewhere in Scythia, has not been identified with any now known.

to have been unknown to him. As the Halys is unnoticed, we can hardly suppose him to have been acquainted even with the interior of Asia Minor. Besides these rivers, we have a long list of aquatic nymphs, called by the commentators, sea nymphs; but, as that province belonged to the Nereids, we are inclined to consider the present catalogue as river goddesses; and their names, where the etymology is most obvious, will confirm this view, such as swift-flowing, fair-flowing—affording pasture to sheep—and rosy, ideas evidently connected with rivers, and not the sea. The poet reckons up more than forty of these Oceanides,* but informs us that he spares as many more, as their total number amounted to three thousand: the nymph Calypso, that old acquaintance of the readers of the Odyssey, is among those here named. The infernal and awful river Styx also belonged to this family.

2. Hyperion and his sister Thia (l. 371) produce the sun, the moon, and aurora. Here again the allegory is physical and obvious.

3. Crius espouses Eurybia, daughter of Pontus (l. 375). These characters in themselves are obscure; but we soon find ourselves still in the midst of physical allegory, for Astræus, their first-born, takes unto himself his cousin Aurora, (of the family last-mentioned,) and from them spring Lucifer and all the stars of heaven, and the several winds.

Pallas, the second son of Crius, also espouses a cousin, Styx, the daughter of Ocean (l. 383). The Stygian descendants belong to the moral school of personification—Zeal and Victory, Strength and Force.† "These always dwell," saith the poet, "with Jove, the thunderer; nor is there any station or path where they follow him not as their chief." Their mother Styx, (the most sacred of oaths,) is also equally associated with him. The mythological account given for this is, that Jupiter thus rewarded the fidelity of Styx, when the Titans rebelled against him. It is sufficiently obvious why these attributes of almighty power should be associated with

* The introduction of the Oceanides as the chorus in the Prometheus of Æschylus, sympathizing with the sufferings of that cruelly-oppressed victim, must be familiar to every reader of the classics.

† We have before observed that Æschylus has borrowed these personifications, but we may be more surprised to find a very similar group in the Northern Edda, where, in the Vafthrudnismal, stanza 51, we read:—

Vidar oc Vali	The warlike heroes Vidar and Vali
Byggia ve Goda,	Dwell in the hall of the gods,
Modl oc Magni.	And Courage and Force.

In Æschylus these characters clearly represent might, as opposed to right; they enforce a passive submission to the most tyrannical and unjust commands of Jupiter, and reproach every natural expression of pity in Vulcan, while constrained to fetter the oppressed Prometheus to the rock. We cannot well conceive a more revolting picture of the attributes of a being adored as the supreme God, and must wonder how it could have been drawn by any of his professed worshippers, and represented among such in public and almost religious ceremonies.

the ruler of Olympus; and the sovereign guardian of oaths is appropriately attended by their most inviolable form.

Perses, a third son of Crius, espoused Asterie, a daughter of his uncle Cœus (l. 1409). From the bride's name, we naturally here expect an astronomical or astrological allegory. Hecate is the daughter of this union.* The offices of Hecate are mysteriously and strikingly described. Jupiter has allotted to her a share of the earth, the ocean, and the starry heaven;—she is most honoured by all the gods, and the most efficient deity who can be invoked by human prayers;—she possesses exclusive influence over the elder race of Titan gods, nor has Jupiter abridged any of the prerogative which she exercised under that earlier dynasty;—she bestows on her votaries victory in war and success in the peaceful conflicts of the games;—the mariner looks to her for deliverance in the storm, and the hunter for success in his chase; she gives increase of flocks and herds, and is the guardian and patroness of the young of the human race. The scholiast informs us that Hesiod is thus copious in the praises of this goddess, because she was the especial object of worship in his own country of Bœotia. Virgil and others would lead us to identify her with the triple power of Diana:

"Tergeminamque Hecatem, tria Virginis ora Dianæ:"—

in the heavens the moon, in the earth the huntress goddess, and in the infernal regions Proserpine. This may well illustrate the inextricable confusion of mythology. We have already had the moon as the daughter of Hyperion and Thia, and shall hereafter find Diana and Proserpine among the daughters of Jupiter. If we might be allowed a new conjecture on so obscure a subject, we should be rather inclined to consider Hecate, the daughter of Asterie, as representing the general principle of Stellar influence, pervading, according to the astrologists, every department of nature and every contingency of events. We can easily account how this principle became identified with the moon, the queen of the host of heaven; and the universality of her dominion will be indicated by her triple office in the heavens above, the earth, and the shades below.

* Hecate is altogether a very obscure mythological character; she is said to have been also denoted by the names of Brimo and Tithrambo. She is sometimes identified with the triple power of Diana, celestial, terrestrial, and infernal, but more prominently connected with the latter. There is also much confusion between Ceres and Diana; and Proserpine, the daughter of Ceres and consort of Pluto, becomes still more identified with Hecate, as an infernal goddess. Dr. Prichard compares her to Isis, in her maleficient or vindictive character, Egypt. Myth. 141. But the attributes assigned to her by Hesiod are rather benevolent than otherwise, and equally applicable to the heavenly and earthly influences of this threefold power. The name of Hecate does not, we believe, once occur in Homer. The fragments ascribed to Orpheus where it does occur, are of doubtful antiquity; and we do not remember any authority in which it is used, from the age of Hesiod to that of the Greek dramatists.

4. Cœus is only known as the husband of his sister Phœbe and the father of Asterie; and by her the grandfather of Hecate, whose influences have been just described.

5. Kronus, or Saturn, by his sister Rhea, (l. 453,) became the parent of Jupiter and his well known brethren, who continued to retain in the popular system of belief, their high celestial power as the principal deities, viz. Neptune, Pluto, and the goddesses Juno, Ceres, and Vesta. Jupiter, although we have mentioned him first, from his ultimate rank, was the youngest of this family. The well known legend is here introduced, how Kronus, having learnt that one of his children was destined to dethrone him, devoured all his children on their birth; which the allegorists would explain of Time, swallowing up his offspring, years, months, and days. The disconsolate Rhea, when pregnant with her youngest child, has recourse to the counsel of her own parents, Heaven and Earth; they convey her to Lyctus, in Crete, where she is safely delivered of Jupiter, whom she conceals in a cavern of Mount Aegæus. Returning to Kronus, she offers him, instead of the baby, a stone, wrapt in swaddling clothes, which he swallows without suspecting the deceit. Jupiter grows up and thrives; and fulfils the fates by displacing his parent, having first obliged him to disgorge all his former children—an operation not very delicately conceived.* The stone last devoured was first thrown off, and Jupiter erected the substitute which had preserved his infant life in Pytho, beneath Parnassus.——The Theogony appears in this place mutilated, for we naturally expect a narrative of the manner in which Kronus was now dethroned by Jupiter; but this is rather indicated than explained in a single line, where we are told that he was vanquished by the arts and force of his son. We are also informed that he released from the durance in which they had been kept by Kronus, his uncles, Briareus, Cottus, and Gyges, the hundred-handed offspring of Heaven and Earth, and the Cyclops, who repaid him by the gift of thunder and lightning. Confiding in such formidable support, he securely rules over mortals and immortals. We shall have further to consider this subject hereafter, when we come to examine the

* Apollodorus describes the medical process with great naivetè; he tells us, that after Jupiter, under the care of the Curetes, had arrived at manhood, he consulted with Metis, or Prudence, and at her suggestion administered to Kronus an emetic dose, which produced the effects described in my text. His brethren, thus singularly recovered, became allies with Jupiter in a war against Kronus and the Titans, which is made to commence at once, although Hesiod appears to place some interval between; but this may perhaps only be an *appearance*, arising from the inartificial structure of his poem. This war continues, with doubtful success, for ten years; when Earth delivers an oracle to Jove, that if he will free her Cyclopian children, &c. from Tartarus, they shall secure to him the victory. On this, Jupiter kills their jailer, Campes, and delivers them, and they reward him by confirming his empire. If such be indeed the just sequence of events in this mythical tale, we must confess that it has been very confusedly related by Hesiod.

rebellion of the Titan gods, the brethren of Saturn, against his offspring, Jupiter and his brethren.

6. Iapetus espoused Clymene, (or, according to Apollodorus, Asia,) the daughter of Ocean, (l. 507,) the first of their children was Atlas, doomed to support the heavens in the extreme west, near the Hesperides; a tale for which we need probably look for no more recondite solution than the simple supposition, that it repeats the language of the mariners who navigated the Mediterranean, the only sea known to our poet, and naturally represented the peaks of the chain of mountains which skirted the south-western horizon, beyond the extreme boundary of their voyages, and seemed to support the heavens where they considered the earth as ending. The brethren of Atlas were, Menoetius, of whom we know nothing beyond his being here mentioned as an opponent of Jupiter's, and by him cast into Tartarus, together with the Titans, and Prometheus, and Epimetheus, whose legends we shall hereafter have to examine.

But here we may well close our present article, intending to conclude our survey of the Theogony in a future number; for the point at which we have now arrived marks one of the great divisions of this poem, and the remaining portion is distinguished by the greatest diversity of character. Hitherto, after the introductory addresses to the Muses, we have been entirely engaged in somewhat dry and unpoetical genealogical tables, with little or nothing of sustained narrative, such as will be found to occupy almost all the rest of the poem. The fables of Prometheus and the wars of the Titans and Typhœus against Jove, are subjects, therefore, which will demand rather poetical criticism than mythological illustration. Heyne has justly remarked on the superior delicacy and beauty of the fables which follow the exaltation of Jove to the throne of Olympus, and which seem to be more purely the offspring of Greek invention. The obligations of our own Milton also to much of this portion of the Theogony, will form a very interesting subject for our examination.

I cannot better conclude these intricate, and, it may be feared, often unsatisfactory mythological discussions, than by quoting a passage in the Phædrus of Plato, in which Socrates is introduced as saying of such enquiries:—"I might otherwise esteem such subjects interesting, but that they require an excess of ingenuity and labor in the student, and seldom repay him with success; which needs no other argument but that a necessity will be imposed upon him to give a correct explanation of the Hippo-Centaurs and Chimæra, and a crowd of the like objects will flow in on him; the Gorgons and Pegasus, with a multitude of similar inexplicable natures, devised by the forgers of prodigies; in which, if any one, sceptical as to the vulgar creed of their real existence, should proceed to seek a more probable allegorical sense, applying himself to them as to a rustic body of philosophy, he will need indeed much of leisure—but this leisure for such investigations is entirely wanting to myself."

ON COMPARATIVE PHILOLOGY.

So capricious is the human mind in the desire of knowledge, that while it would be grieved if nothing remained to learn, it is discouraged at the thought that too much remains to learn. We love to see before us neither a blocked up way, nor an immeasurable plain; but a landscape of suitable extent. Accordingly, the vast accession of facts to be known and studied, which modern literature has opened in all departments, has a tendency in many cases to palsy the mental powers: a tendency, however, which is counteracted, when general principles are discovered, around which the details naturally arrange themselves. Few studies seem to the world at large so tasteless as Philology. The numerous names of languages and dialects with which the British public has been made acquainted, chiefly by means of the Bible Society, are enough at first to inspire disgust in the mind, which, conscious of its powers, fancies the whole range of science its natural possession. While this is a useful check against the craving insatiate desire of knowledge for its own sake, and an admonition that all is vanity, save as God is in all the final end of our adoration; those who will so take it, will find in every field of nature so much the more instruction the more varied and extensive it is. Philology is not therefore an unreal science, because it has to do with words; for words are *facts*. Language is a record of the human mind. The science is degraded by being supposed to deal only in the elegancies of composition, of which most are factitious, or in the dogmas of grammarians, of which many are false. Sir William Jones gave the first impulse to the inquiry concerning the affinities of languages, through which modern Philology has taken so new and so interesting a shape. But in his day it was premature to attempt so arduous a problem as to decide on the number of primitive tongues, even of Europe and Asia: and it would seem that we are not yet agreed on some preliminary questions involved in treating such a problem. In the expression *primitive tongues*, I mean what all mean, who, believing the records of Moses, see no ground to doubt the popular interpretation of the miracle at Babel: and without such a miracle, it appears impossible to believe the descent of the human race from a single pair. But what points of similitude are to be confidently expected in any two dialects of one and the same language? for unless this can be safely answered, our inquiries will soon meet their termination. We ought to seek a reply, by induction from those languages which are *historically* known to be, and from those which are supposed not to be, akin: for although *à priori* considerations are quite in place, they must be checked by historical facts.

The agreements between kindred dialects may be *first*, in the material of speech, or *secondly*, in the structure of grammar: in the words, as roots, or in the mode of inflexion: and it is alike agreeable to reason and illustrated by fact, that such dialects retain very generally those words which

express *the cardinal numbers, family relations, parts of the human body, the principal objects of nature, domestic animals,* personal pronouns, and *certain familiar actions or passions.*

But here, if the positive argument in favour of the connection of dialects which have these in common, be conceded to be ever so strong, the disproof arising from a defect in these is not so strong. It is certain that in Arabic eighty words are alleged for *honey,* and two hundred for *a lion;* both ideas very familiar. Indeed, the commonest words seem sometimes to have most tendency to change their names.* In a note will be found a very small selection, (for space will allow no more,) to illustrate the extensive changes in very familiar words, happening in dialects which differ so little as to be almost one and the same language in every thing beyond what is familiar: for Hellenic and Romaic have their vocabularies considerably different, while conversation runs on every-day topics, but may be called identical upon higher subjects.

It seems then that the non-agreement of two languages in their most familiar material, is no very decisive disproof of their real connection by pedigree; and this leads to remark, that equal uncertainty is hereby thrown on the argument, that two languages must needs be akin, which have some of these familiar elements in common. For *if they are in any proximity,* and if it have been proved that men are not untractably tenacious of their own vocabulary in these matters, nothing hinders that one language should borrow them from the other. Especially is it easy to borrow numbers; for in two conterminous or mixed races, each is sure to learn the numeration table of the other.

When, however, such agreement is found between languages spoken by nations which can have had no intercourse with each other from the remotest ages; and after deducting all resemblances which can be with any shadow of reason called uncertain, if but a dozen words are left in common; if these are all found among the primary elements of speech, they are too many to be supposed accidental coincidences. Such appears to be the case made out by Dr. Prichard for the connexion of the Celtic languages with the Sanskrit. If we resist the notion of a common origin, we must apparently believe that the Celts learned these names, directly or indirectly, from the Sanskrit; suppose, directly from the Goths.

The second point to be considered, is the agreement between two languages as to *the mode of inflexion.* And here also experience assures us,

	Hellenic.	Romaic.
*Black	μέλας	μαῦρος
White	λευκὸς	ἄσπρος
Gold	χρυσὸν	μάλαγμα
Horse	ἵππος	ἄλογο
Dog	κύων	σκυλάκι
Ass	ὄνος	γαΐδαρο
Pig	σῦς	μουχτερό

	Hellenic.	Romaic.
Cat	αἴλουρος, or γαλεώτης?	γάτος
House	οἶκος	σπίτι
Bread	ἄρτος	ψωμὶ
Water	ὕδωρ	νερό
A Rose	ῥόδον	τριαντάφυλλον

that the want of agreement is *no disproof* of their connexion; and probabilities seem to teach, that the existence of such agreement is of all arguments the most powerful to *prove* a connexion. Certainly no well-informed Philologists now doubt whether Gothic, Sanskrit, Greek, and Latin, have a common origin; yet who would suspect English and French to be any way connected at all, by a comparison of their conjugations? Again, it is notorious that the inflexions of nouns very easily rub off, dual numbers and neuter genders vanish, prepositions are doubled and tripled, and new prepositions supersede the old ones; all which phænomena are remarked in the familiar instances of Greek and Latin, compared with their modern dialects. It seems then unreasonable to reject the evidence of the kinsmanship of languages founded on *positive agreement*, by the argument that their *disparities* must first be accounted for. Is it only by such reasoning that some recent writers question the connexion of the Persian with the Sanskrit?

On the other hand, it is certain that in the nations best known to us, a great repugnance is displayed to borrowing *foreign inflexions*. Caprice or convenience may introduce a few, (as the terminations *ize* and *ism* in English,) but only among the more literary. Illiterate persons appear unable to master the intricacy of foreign grammar. Similar in fundamental principles as was the old German to the Latin, the languages could not mix without a great destruction to the inflexions of both; since neither party will adopt the inflexions of the other. The *lingua franca* of the Mediterranean shows the same thing. It is also remarked, that, while the intolerant efforts of the Saracens to abolish the old Farsi language, has introduced so large a body of Arabic words into modern Persian, no Persian words submit to a single Arabic inflexion. Now this is a question at once interesting and important to the whole inquiry, whether we are justified in regarding the rule to be universal, that languages *do not* borrow from each other their affixes, suffixes, and their principles of inflection: or whether it is to be believed possible that languages may have these in common, and yet be unrelated by genealogy.

If abstract reasonings will not settle the question, neither will any but a *very* ample induction of fact settle it. For it will always remain possible, that while some nations readily borrow *words*, but refuse to borrow *inflexions*; others, very barbarous and very destitute of inflexions, might be happy to borrow these, while they did not want words. In fact, children who hear two languages readily adopt the inflexions of the one in speaking the other, often selecting with care those words and modes of expression which are at once easiest and shortest. The writer remembers sentences such as the following, uttered by children who heard both English and Arabic.—"No more doua, [medicine,] papa."—"I give you kisseyn, [two kisses]." It may be asked, when a savage tribe, whose language, as their minds, is as unformed as that of a child three years old, migrates in great

numbers to live in the neighbourhood of others who have learnt to express their sentiments accurately; what improbability is there that they will keep their own vocabulary, but learn to inflect it from the foreigners? To disprove this, appears to need an extensive induction concerning the habits of the savage mind, such as *savage* communities are not likely to afford. Again: while in the collision of languages, inflexions are destroyed, as has happened in Europe and southern Asia; contrariwise, in the desarts of Arabia and Africa, a vast variety of vocabulary might co-exist with unchangeable inflexions of grammar. For tribes that live apart have no tendency to change these latter; while the love of *slang* terms and other inexplicable causes, induce a considerable change in the vocabulary. The copiousness of Arabic is only an illustration of this.

There is a language which has of late excited curiosity in Europe; that which is talked by the Berbers of Mount Atlas. It is said to be identical with the language of the Tuaricks, and of the other straight-haired nations of north-western and central Africa: whose branches (says Prichard) "extend from the Oasis of Siwa on the eastern, to the mountains of Atlas, and even to the Canary Islands, on the western side." That there were two great nations in the northern half of Africa, Ethiopians and Libyans; the former, straight-haired and with European features; the latter, woolly-haired, in short, negroes; the ancients were aware. The Berber language, should it be compared with that of the Berberins of the Upper Nile, might throw great light on the composition of the inhabitants of Africa. A translation of the twelve first chapters of St. Luke's gospel into the language of the Berbers of Mount Atlas, was procured at Algiers by the French, and having found its way to England, was published by the Bible Society. If the task prove not too difficult, we propose before long to lay before our readers such a concise account of the nature of this language, as may convey instructive information without the tedium of mere details. At present some general remarks must suffice.

It is written in the Arabic character, with slight modifications. It has a large assortment of Arabic roots, but not in the most familiar objects and ideas. In fact, the whole material of the language seems opposed to Arabic, as much as vulgar English is to French: yet many of its grammatical peculiarities and inflexions very nearly resemble Arabic. English is of triple formation, being originally Saxon, then mixed with Norman, and thirdly, infused with Latin and Greek by the learned; so *may* the Berber have originally been of the Shemitic stock, have been corrupted with Negro dialects, and in a much later age have received a new infusion of Arabic, at a time when its common words had lost all resemblance to Arabic; just as much as *earth* and *terre*, *water* and *eau*, *child* and *enfant*, *horse* and *cheval*. This *possibly may* have been the case; but on the other hand, a few of the Berber inflections prompt the inquiry whether they may have been all borrowed. The most striking fact of this sort, on the face of the

language, is, that *nt* is the termination of the third person plural in the verb; in which point the European languages agree with the Celtic and the Sanskrit. Which has copied from which? for who can believe it to be accident? In this matter may be adduced the fact, that the pronoun *I* (whose characteristic in Greek, Latin, Sanskrit, &c. is *m*,) is in Persian *măn*, in Ottoman *ben:* the Turkish of Tabreez makes the oblique cases, *mănim*, *măna*, *măni;* and the plural *biz;* and in all Turkish, the suffixes indicating the first person, singular and plural to verbs or nouns, are *m* and *maz*, *mez*. Here the similarity to Greek and Latin is too striking to be believed accidental: yet it is an axiom with Linguists, that the Tartar and the Gothic are as separate in origin as the Greek and the Hebrew. Again; the Coptic and the Hebrew are perfectly dissimilar; yet *I* is in Coptic *ànoκ*, in Hebrew *anoki;* and *thou*, is in Coptic *nˋθoκ*, in Hebrew *ătta*, from Arabic *enta;* while in all three languages K is the immutable element* in the syllables expressing *thy* or *thine*. So much would alone be curious; but now it is to be added, that in the Berber, *I* is *nakki*, *thou* is *Kattshi*, and K plays the very same part in the suffix of the second person. So much has been here stated, merely to show that the question needs to be considered thoroughly, whether languages may not borrow each other's pronouns and inflexions, while their whole *material* remains incongruous. In the decision of which, facts must be the chief guide; and every fresh language of acknowledged antiquity and of affinities as yet unknown, may throw fresh light on the subject. Indeed the Amharic language, which at first was supposed a dialect of the Gheez, and thus to be Shemitic, is now alleged by the most recent inquirers to be of African pedigree, and only to have imitated Shemitic inflexions.

It will be remarked, that in stating what is to be expected in common to two kindred languages, no notice has been taken of the composition of the alphabet. In truth, these are so seriously altered by unknown laws of euphony, that they furnish no criterion at all. Almost might it seem as though latitude, climate, and habits of life affected these things; yet it would be most untrue to suppose that savages talk with rough consonants, and polished or effeminate nations with soft ones. But while Greek was celebrated for harmony, and of the consonants which the English consider oriental had not one, if it was not *ζ* or *σσ*, (for the *χ* we have in Europe on every side of us,) Sanskrit has all the Arabic consonants, *ain* only excepted. This *ain*, so decidedly peculiar, exists in the Berber, even in words that do not appear in the existing Arabic. Yet the same may be said of Persian, which equally contains this letter in old Farsi words. On the whole, the discussion of the elementary sounds of a language appears to yield but a very feeble help to an argument of this nature.

* This seems to show, that the oldest Shemitic forms are, *entak*, thou, *entakum*, ye, and *entak*, *nˋθoκ*, are manifestly the same.

ESSAY INTRODUCTORY
TO THE
ARCHÆOLOGY OF THE WEST OF ENGLAND.

Part I.

Although in a Journal of Science and Literature, science will of course occupy a prominent part, it was never intended that it should engross the whole, and of that portion of our Journal which is to be devoted to literature, we trust that the activity of our correspondents will not suffer Archæology, in its broad and most valuable signification, to fill up an unimportant share: it would indeed be unpardonable, if, in a Journal emanating from the metropolitan city of the West, a portion of its pages were not to be devoted to the illustration of the vast archæological domain, of which that metropolis is the centre.

A variety of circumstances have conspired to make the south-western provinces of Great Britain peculiarly abundant in the remains, philological, traditional, and topographical, of every period of British history. The ready communication by sea subsisting between those provinces and the continent of Europe, the variety of surface into which the ground is moulded, the fertility of the soil in some parts, and the rich and readily worked mineral treasures in others, are causes, which seem long since to have attracted an early, and given rise to an abundant, population, whose physical traces still remain, in their extensive camps, in the altars and temples of their religious worship, and in their sepulchral monuments; vestiges of all which, though found occasionally throughout the country, are more numerous, and on a more extensive scale, in the west.

An archæological enquiry into the history of the nations who have occupied a country, depends for its success upon four sources of information; 1. the philological remains; 2. the traditions of the country; 3. the document of regular history; 4. the topographical antiquities; and to these might in many cases be added, the testimony derived from the physical conformation and intellectual character of the inhabitants. The substance of the present essay will be directed towards the elucidation of the fourth of these points, the topographical remains; but even this limited view would be imperfect without some preliminary observations upon the rest.

We shall in the first place consider the ancient connexions subsisting between the inhabitants of Iberia and Gaul, and those of the British isles. Confining our observations more particularly to the latter, we shall in the second place consider their history, language, religion, and topographical antiquities, under three successive æras—the British or aboriginal, the Roman, and the Anglo-Saxon, with the Danish interregnum. The Norman Conquest, and the changes in arts and architecture which accompanied the commencement of the latter, will form the third and principal portion of our essay, to which indeed the two previous parts may be considered as subordinate and introductory.

If we take a survey of Spain, France, French Switzerland, Belgium, and the British isles, we shall find, with certain limited exceptions, the languages spoken by their inhabitants, to bear more or less evidence of two common sources, the Latin and the Teutonic. Of these the former, the most southern, chiefly prevails over France, western Switzerland, and Spain; the latter, the northern, over the rest of Switzerland, Flanders, and the British isles. History tells us that these two languages were not originally those of the country, but that the former was first introduced by the Romans in the century preceding the Christian æra; and the latter by the Teutones or Germans from beyond the Rhine, in the fifth century of that æra; and this testimony is corroborated by existing evidence.

M. Fréret has observed, and the observation is generally considered to be a just one, that the oldest inhabitants of any land are to be sought for in its remote and least accessible parts; now there are found, in the secluded and mountainous regions of the above-mentioned countries, the remains of tribes who still employ languages, differing in some respects among each other, and differing still more from the Latinized and Teutonic dialects of the plain country; and the habits, customs, traditions, and character of these mountaineers are equally dissimilar.

Upon comparing the languages of these tribes, with the general geographical nomenclature of the country, the names, otherwise unintelligible, become in them applicable and significant; a convincing proof of the antiquity of those languages, since, as was well observed by the noble president of the late Eistedfodd, the names of the great physical features of a country are always those conferred upon them by its earliest inhabitants, being very rarely found to undergo a change.*

The countries in which these earlier languages are still prevalent, are those around the Pyrenees, Brittany, the western coasts and islands of England, the principality of Wales, southern Ireland, and the Highlands and islands of Scotland.

The languages in question are reducible to two only, of which one is the Basque, the other the Celtic, of much greater extent, and containing two principal dialects; 1. the Cambro-Celtic, including the subordinate dialects of Welsh, Cornish, and Armorican; and 2. the Erse, including the Irish, Highland Scottish, or Gaelic, and the Manks.

Spain was anciently called Iberia, from the Iberus or Ebro, the principal

* An analysis of the list (a very limited one) appended by D'Anville to his Geography, gives, out of thirty-three terminations in *Magus*, twenty-five in Gaul; out of twenty-eight in *Briga*, twenty-five in the Spanish peninsula; of twenty-five in *Dunum*, fifteen in Gaul and six in Britain. Venta was a common name for a capital city; it is the Latinized "gwent or went," the Celtic for the "open country." Dunum, dinum, donum, seem all to be Latinized forms of the Celtic "dun," a fortified place. Isca, water; dur, water; abon, or avon, a stream; are common names of rivers both in Gaul and Britain.

of the rivers falling into the Mediterranean, from which side the country appears to have been first peopled.

The Iberi, the primæval inhabitants of the country, are supposed to have spoken a language of which the Basque is the only representative. Of their race were probably the Turditani, a cultivated and comparatively polished people, dwelling round the river Bœtis or Guadalquivir. The Iberians seem also to have extended themselves along the southern coast of the yet unpeopled Gaul, as far as the Alps and the mouth of the Arno; whence they were subsequently dispossessed by the Ligurians, a people whose origin is lost in its antiquity. The Iberians also are stated by Thucydides to have peopled Sicily. Superimposed upon the Iberi, having wrested a portion of the peninsula from their rule, was a Celtic colony, which, crossing the Pyrenees from Gaul, seems gradually to have occupied the territory between the Tagus and the Anas, and mingling with the natives, to have formed the Celt-Iberi, and the Bœtic Celtæ, a portion of them inhabiting Bœtica.

By degrees the Iberian language has vanished from the peninsula, and it is considered only as highly probable that it is represented by the Basque. The Basque, or Vascon, is spoken on the western Pyrenees, and between these mountains and the Garonne, the ancient Aquitania; names apparently belonging to it, are also to be found scattered over the whole extent of country which has been stated as forming Iberia. It should be further observed, that the Basque is utterly unconnected with every other European tongue, and that even its connexion with the great Indo-European stock is to a certain degree obscure.

Such is the presumed origin of the inhabitants of Spain; and the Iberians are to be considered as the oldest people of Europe, the first great offshoot from the Indo-European stock. We next pass on to Gaul.

Cæsar speaks of Gaul as inhabited by three great nations, the Celtæ, Belgæ, and Aquitani, differing in language and in customs. The territory of the Aquitani, being as we have seen confined to the lands west of the Garonne, occupied but a small portion of Gaul, which may therefore be considered as chiefly inhabited by Celtæ and Belgæ.

The Celtæ occupied the larger territory, their boundaries were the Seine, the Maine, the Garonne, the Upper Rhine, and the Mediterranean sea. The territory of the Belgæ was confined between the Lower Rhine and the Seine, and lay to the north. The Celtæ, probably from their central situation, are said to have mingled but little with foreign nations; but the Belgæ had intermarried with the Trans-Rhenane Germans, and the Aquitanians were closely connected with the inhabitants of the peninsula.

Strabo, who adopted the above division of Cæsar, carries the Belgæ along the northern coast of Gaul beyond the Seine to the Loire, and speaks of those lying between the two rivers as paroceanitic or maritime Belgæ.

The epithet "Celtic," from the great preponderance of the Celtic terri-

tory, was applied subsequently to Gaul generally; and the terms Celts and Gauls became synonymous for its inhabitants. Much of the evidence concerning the Celtic and Belgic inhabitants of Gaul depends upon observations made upon Britain, concerning which it will therefore be necessary in the first place to say a few words.

Cæsar, to whose pen the earliest accounts of that island are due, landed there, A. A. C. 55; but being ill prepared for a campaign, speedily retired, purposing to return in the following year. This intention he accordingly carried into effect; and seizing upon the capital (Verulam) of Cassibelan, chief of the Cassii, and leader of the British confederacy, thus obtained a permanent footing in Britain. At the period of Cæsar's arrival, as we learn from himself, and subsequently from Tacitus, the British isles were thickly peopled. Upon the southern frontier, south of the æstuaries of the Thames and Severn, and of a line connecting them, the tribes described themselves as of Belgic descent; and this opinion was corroborated by the similarity of their religion, customs, speech, and the names of their tribes, with those of the Belgians of the neighbouring coasts of Gaul. Thus Hampshire and Wilts were occupied by a tribe called "Belgæ," Gloucester and Berks by the "Atrebatii," names obviously connected with the Belgæ and Atrebates of the continent.

Beyond these, the latest emigrants from Gaul, were a race of men occupying the central and northern parts of England, more barbarous and fiercer than the Belgæ, who considered themselves to be Celtæ, the offspring of the original inhabitants of the land, and who appear to have been related to the Celtæ of central, as the Belgians to the Belgæ of northern or maritime Gaul, having been driven over as an earlier wave of emigration. The proofs of their Celtic origin are numerous.

In Gaul the Celtæ were the chief depositaries of Druidism, so were the central tribes of England, as witness their college at Mona or Anglesey.

In Wales, Cornwall, and the isles, the stone circles, Cromlechs, &c. evidences of a remote and pagan worship, are similar to others in Celtic Gaul, and more especially in Brittany. The language spoken by the Welsh is so nearly allied to, or rather so identical with that spoken by the Britons or Armoricans, that the people are able to comprehend each other, and the names of places occurring through a great part of Brittany are significant in Welsh. With respect to the emigration at a later period of certain insular Britons to Brittany, an event, which though abundantly exaggerated as to its circumstances, did beyond a doubt take place, it will be found by no means adequate to explain the above coincidences; and on the whole it seems nearly certain, that the emigrants soon became mingled with, and lost in a people who spoke a language so closely resembling their own, the dialects of Celtic Britain and Celtic Gaul being cognate.

We next arrive at the Belgæ, both of Gaul and Britain, inhabiting the neighbouring shores of each. The origin of the Belgæ has been much

disputed, but although it is highly probable that many of their tribes bordering on the Rhine had connected themselves with the Teutonic nations beyond it, and might therefore be considered as in some sort of Teutonic originals, yet this descent can hardly be predicated of the whole nation, which was probably of Celtic stock. Strabo speaks of the difference between the Celtic and Belgic tongues as slight, and only dialectic, in which opinion he is supported by the implied authority of Tacitus.

The names of the Belgic waters, of their headlands, and even of their towns, so far as they have been analysed, are all Celtic, and the term "Venta" expressed a capital city among both nations.

The language of the Celts remains, as we have said, in Brittany, and its dialects the Cambro-Celtic, and Erse, along the western side of Great Britain. That of the Belgians is now extinct, but it is considered by Dr. Prichard to have been a dialect akin to the Erse.

There is, then, every reason to conclude, that both the central and southern parts of Britain were peopled by Celtic emigrants from Gaul, at a remote period; and that the Belgæ were also Celtic emigrants, but given off at a later period, and impelled by a later wave towards the coasts of Gaul and Britain.

Next comes the question concerning the inhabitants of Scotland. The five northern tribes of England, whose territory lying south of the Friths of Forth and Clyde, and the wall built by Antoninus which subsequently connected them, was named by the Romans Valentia, seem all to have been of Celtic origin, and to have spoken the Cambro-Celtic dialect; they may therefore be considered as out of the question. Mr. Chalmers proves beyond a doubt, by an immense mass of existing evidence, chiefly topographical, and therefore of the most irrefragable character, that the Celtic language must have prevailed, at some time or other, over the whole of Scotland and Ireland. Tacitus, to whose account we are indebted for the first mention of the Caledonians, describes them as of tall stature with flaxen hair; and after the Silures, or South Wallians, the rudest and most warlike inhabitants of Britain. Caledonia, or Celyddon in the Erse or Gaëlic, is the same with Coed in the Cambro-Celtic, and signifies a wood, or woody;—a term very descriptive of the ancient condition of the regions around the Grampians.

At a later period, about the fourth century, the Caledonians were no longer heard of, and the Picts and Scots supplied their place, and equalled them in ferocity. The Picts are supposed to have been a race of invaders from the north-east, and therefore possibly of German origin, who had gained footing in the west of Scotland, before the departure of the Romans from Britain. They were finally conquered by, and merged in, the Scots, A.D. 843.

The Scots, or Gael, appear to have been an Irish colony, who like the Picts, invaded the Celto-Caledonian people, and established themselves,

before the departure of the Romans from Britain, in a portion of their territory.

It would appear then, with respect to both Ireland* and Scotland, that they were originally peopled by a Celtic race, probably the first and rudest who were dismissed from the parent stock. The Irish are said to have received some additions from Iberia; but this is uncertain. The Caledonians were overrun by the Scots, an Irish, and therefore Celtic colony, and the Picts, who appear to have been a Germanic nation. The whole merged finally in the Scots, from whom the land has received its present appellation.

We shall attempt, at the risk of becoming tedious, a recapitulation of what has been advanced.

In the first place, we have the five countries of Iberia or Spain, Gaul, Britain Proper, Caledonia, and Ireland. Of these Iberia seems to have been the earliest inhabited, and by a people whose origin, and that of their language, is uncertain, but probably Indo-European. They extended themselves beyond the Pyrenees to the Garonne, and along the coast of the Mediterranean to the Arno; in all which territory are traces of their language, supposed still to be spoken, as the Basque, in Aquitania.

Opposed to the Iberians, and probably arriving later in Europe, were the Celts, certainly an Indo-European race, who seem to have crossed the Italian frontier, and spread themselves over Gaul and the British isles. Crossing the Pyrenees, they gained a footing in Iberia, and uniting with the natives, formed the Celt-Iberian nation. At a period probably later, a new wave of emigration was set in motion, also from the Celtic stock; and the Belgæ seem to have been given off, who possessed themselves of the north of Gaul and south of Britain. Whether the Celtæ of England are to be regarded as a wave distinct from and later than the Caledonians, or whether the physical circumstances of their country rendered them less ferocious, does not appear. The Caledonians were overthrown by the Celts, Scots, and German Picts, at a period within the historic æra.

With respect to languages in general, it has been remarked, that those first thrown off from the parent stock, are, as might have been expected, rude and simple in their grammatical structure. Thus while the Sanskrit, Greek, Latin, Slavonic, and Teutonic branches of the great Indo-European stock, are in their grammatical structure elaborately refined, the Celtic dialects which shot off earlier, are rude and simple.†

* The names of places in Ireland are for the most part Celtic. Reference to the list given by Chalmers will sufficiently prove the truth of his assertion, that the topography of Ireland shows more Celtic names than that of any other country.

† The coincidences between the Celtic, an early, and the Greek, a dialect of the Pelasgian, a later offshoot, is remarkable. Thus: the Gaulic horsemen were accompanied by two retainers, also mounted, one of whom assisted his master when wounded, while the other supplied his place. This arrangement was called by the Greeks Τριμαρκισια; the Welsh word is Tri-march. Θυρεὸς, a shield, resembles the

With respect to the languages of the nations whose distribution we have been considering, we have the Iberian, represented by the Basque, and supposed to be unrelated to any other known tongue, though possibly itself an early Indo-European offshoot; next we have the Celtic, the language formerly of Celtic Gaul, and to this day, of Armorica or Brittany, and its dialects, the Belgic, that of Belgic Gaul and Belgic Britain, now extinct, and supposed to have resembled the Erse; the Cambro-Celtic or Welsh, still spoken in the Principality; the Gaelic or Erse, also spoken in the Highlands of Scotland, Ireland, and the Isles.

Such, then, are the countries, and such were their inhabitants and languages, a slight account of which appeared to be a necessary prefix to any more detailed observations upon the Archæology of even a part of England. The circumstances under which we write, necessarily preclude a longer essay, or more accurate detail, upon this merely introductory part of our subject. Those who are desirous of gaining more than a superficial knowledge of this subject, will do well to consult such works as Chalmers' Caledonia, Gillies' History of the World, Thièrri's Histoire des Gaulois, the Appendix to Conybeare's Theological Lectures, Professor Murray's work on the European Languages, and above all, as a condensed, and perfectly clear summary of the whole, together with a vast quantity of original observation, the Physical History of Dr. Prichard, including his separate tract upon the Celtic nations. All which books, with many others on the same subject, may be conveniently referred to in the Bristol City Library, which will be found tolerably strong in this department of literature.

Welsh tarian. Γαισὸς, possibly connected with gwayn, a javelin. The Welsh borrowed cleddau from the Latin gladius, the ancient term Σπάθη having vanished, if indeed ever possessed by that language. Gillies supposes some of these to be Teutonic; they are evidently Celtic. In Galatia, we find the city Ecco-briga, clearly a Celtic termination; and St. Jerome tells us, that as late as his time, the Galatian language was similar to that spoken at Treves: wherefore Celtic, and not Teutonic, must have been the language of the Trevi.

(To be continued.)

Essay on Caerphilly Castle.

No. II.—TOPOGRAPHY.

(Continued from p. 71.)

We next arrive at the consideration of the ground upon which the castle of Caerphilly is constructed.*

The hundred of Senghennyth, or Caerphilly, extending from the first rise of the mountains above Cardiff, to Merthyr, on the south and north; and

* We regret that, owing to unforeseen circumstances, the ground plan of Caerphilly, which had been constructed for the illustration of this account, has not been appended to this number; we shall supply this deficiency when the next part of the article appears.—Ed.

from the river Taafe to the Rhymny, on the west and east; includes within its limits a vast basin, bounded on three sides by mountains, rather vast than lofty, and terminating towards the east in a spacious valley, down which, descending from the northern range, the river Rhymny, the boundary of Glamorgan and Monmouth, takes its course to the Bristol Channel. The scenery of these mountains is of that peculiar variety which characterises what is called by geologists, the carboniferous formation.

Along the base of these mountains, and extending some way up their skirts, here, as in many vallies in the neighbourhood, lie vast deposits of gravel and sand, composed of the debris of the neighbouring rocks, and supposed to have been brought down by diluvial agency.

Near the centre of the basin which we have described, and south-west of the line at which it is crossed by the Rhymny, is a bed of this gravel, of very considerable extent and thickness, the surface of which has been wrought deeply, by some natural process, into a series of furrows and eminences.

A narrow tongue of slightly elevated ground, being the termination of an extensive peninsula, divides by its projection a swampy flat of considerable breadth, into two unequal portions. The two plains thus separated are contained, in the opposite direction, within irregular banks of gravel, similar to, though something higher than, that of the central peninsula. The southern being shorter and almost parallel to it, while the northern is prolonged and curves around its point, until it is separated from the southern only by an inconsiderable gorge, and thus the swamp assumes a shape something like that of a horse-shoe.

South of the peninsula, between it and the southern bank, a considerable stream, the Nant-y-Gledyr, takes its course, and passing in an easterly direction towards the gorge, becomes tributary to the Rhymny, at the distance of about a mile.

On the opposite side of the peninsula, a rivulet at first parallel to, but smaller than the Nant-y-Gledyr, occupies a narrow depression between the banks, which here closely approximate, and thus finds its way into the lesser or northern swamp; whence, coasting round the prolongation of the peninsula, it seems anciently to have fallen into the larger stream at the above-mentioned gorge. There is, however, evidence of a smaller branch, whose channel diverged towards the north-east.

The tongue of land which we have described, was in all respects admirably suited for a barbarian encampment; and there is strong reason for supposing that the ancient castle of Senghennyth was nothing more than a rude structure, erected upon this tongue, and defended by a transverse trench, converting the peninsula into an island. Such a work would have been perfectly in unison with the habits of the early Britons; and the supposition is borne out by a reference to other rude fortifications still extant in the country.

The neighbouring brooks would amply supply the inhabitants with water, the morass was a sufficient safeguard against their enemies, and the surrounding plains would afford food for themselves and pasture for their cattle—if they had any.

When, however, the more civilized Normans obtained possession of this spot, and laid the foundation of the present extended structure, the surface of the ground seems to have undergone very considerable alteration. The bed of the Nant-y-Gledyr having been dammed up at its gorge, beyond the termination of the peninsula, the whole southern swamp became at once an extensive sheet of water. The dam, of masonry, in the form of a strong and lofty wall, was carried along in a northerly direction, until it terminated in the bank that has been described as curling round from the north, and thus cutting off also the exit of the smaller brook, the whole horse-shoe-shaped bottom was converted into a continuous lake.

The dam of the Nant-y-Gledyr was furnished with sluices to regulate the height of the inundation; and similar appendages were added on the north, whence, by means of an artificial channel, to the west of the natural one, the waste waters on that side found a way to their ultimate destination. This channel we shall call the "North-brook," and the neighbouring rivulet the "Farm-brook."

Advantage was taken of a narrow slightly lunated ridge, which proceeding from the root of the peninsula, traversed the northern swamp nearly parallel to the tongue of land, dividing it into two portions, a smaller forming the inner, and a larger the middle moat; the outer having been already described as the channel of the north brook.

By this ridge all connexion between the northern part of the northern, and the southern inundation was cut off; with the latter, however, the inner moat still communicated, on the eastern side passing round the peninsula, and on the western through the old transverse cut, now widened and deepened.

The island thus completely formed, was scarped into curtains and bastions, and faced or revetted with stone; and the single transverse cut not being deemed a sufficient defence, the peninsula was a second time divided further to westward; and the second island thus formed turned into a sort of hornwork, or demi-lune.

To recapitulate. We have centrally the apex of the peninsula converted into an island, and protected on two sides by the southern lake and its eastern prolongation; on the north, by the inner division of the northern swamp; and on the west, by the transverse fissure; all uniting to form one moat.

Proceeding outwardly we have next, as the boundaries of this moat, on the west, the second island or hornwork, prolonged on the north into the lunated ridge; on the east, the natural bank and the dam of the Nant-y-Gledyr; on the south, the acclivity of the bank, rising rather steeply from

the lake; and towards the south-west, an open space from whence that lake is supplied by the waters of the Nant-y-Gledyr.

We then arrive at a second line of defence, including however only two sides of the castle. The new trench between the hornwork and the root of the peninsula, along which a streamlet runs from the Nant-y-Gledyr to the farm brook, commences this line on the west; and the outer portion of the inundation continues and completes it on the north.

This middle line of defence is separated from the outermost, also partial, towards the north-west, by a high bank or knoll, the summit of which has been carved into a lunette or redoubt; towards the north by a wall and bank of land, intersected for the passage of the northern brook, and towards the north-east and east, by the prolongation and expansion of this bank, where it curls round and unites with the dam of the Nant-y-Gledyr, as before described.

The outer line of defence is, as we have said, like the last, partial, but its partiality respects the northern and eastern sides; it is composed of a line of moat, broken at the south-east angle into two portions by a strip of land, or causeway, which seems to have been left as a passage from a postern.

The northern limit of this moat commences gradually, in advance of the redoubt; it deepens after receiving the northern brook; and finally, by a channel, partly natural and partly artificial, it passes off towards the Rhymny.

The eastern limb is entirely artificial, it commences suddenly a few yards from the divergence of the other, makes a sharp angle round to the south, and running along the eastern or principal front of the place, terminates in the bed of the Nant-y-Gledyr, just on the outside of the dam. Thus it is separated from the second line, at first by the natural soil, and afterwards by the artificial substance of the dam.

It is by no means easy to convey, by the aid of words only, a correct idea of the disposition of a complex piece of ground, but we trust that with the assistance of the plan which will appear with the next part of this essay, our meaning will be tolerably intelligible.

(To be continued.)

A LETTER FROM CAIRO.

Cairo, *March* 14, 1831.*

. . . . . We left Malta on Saturday evening, the 19th of February, and on the next Saturday were off the harbour of Alexandria. On the Saturday morning early, we came to an anchor, and by twelve o'clock were ashore. To the eye of an untravelled European, as he first

* Although some time has elapsed since the above letter was penned, yet [having the writer's permission] we think it will prove interesting to our readers from the very vivid picture which it delineates of the entrance into Egypt.—Ed.

enters the precincts of an oriental city, every thing is strange. It is a great masquerade, given on an immense theatre. Except in the Frank quarter, the streets of Alexandria are narrow—not more than eight feet wide—and covered from house to house with matted awnings, which form rude bazaars. Latticed oriel windows, nearly meeting above the head, contribute, with the awnings, to subdue the light, and to shed a mysterious *demi-jour* upon the moving masses below. Every one, I believe, is conscious that some change comes over him in passing from the garish blaze of an open street, such as Regent-street, for instance, into the crowded walks of a covered way like the Quadrant. On scrutinizing this peculiar feeling, it will be found to be something more than the simple effect of the diminished light upon the visual sense. A degree of obscurity invests the passer by; you look at him, in consequence, with keener attention, and are aware that you are yourself more minutely observed. You are in fact in a transition state between a street and an apartment, and the *crowd* around you is, in some degree, transformed into *company;* some sentiment of this kind is at work upon first plunging into the narrow passes of this city. Beings, turbanned, capped, shawled, moving slowly along in the burly dignity of eastern costume; Arab women, in blue cotton shifts, the only covering of their squalid bodies, except the universal veil of the same material and colour, which envelopes the head and falls down to the loins; goats, camels, and asses, threading their lazy way through the dense crowd, that scarcely opens to let them pass, and closes like a fluid upon their *wake;* black and naked children; now and then a Turk on horseback, gorgeous in his dress and housings, and all *herissé* with pistols, scymetars, and daggers; Jews, Greeks, Copts, Armenians, squatted cross-legged on the elevated counters of their little open shops, and awaiting, with the immobility of a porcelain Joss, the approach of customers; every colour and every costume that the heart of man can conceive, all huddled together as close and as contrasted as the atoms of a kaleidoscope.—With all these, and much and many more indescribables, are you at once mixed up in the familiar compression of what would seem to be a private apartment, where you have, in some extraordinary manner, become one of the company. But the eye is soon satisfied with seeing: there is nothing at Alexandria to exercise the understanding or engage the heart. The barbarism of a new people it is always curious, and often pleasant, to view and study; but that which follows upon a prior and better state, is observed with very different feelings. Who can look without disgust at the social condition of this once mighty place, where all ranks have now rotted down to one common level, save the barbarian who rules over all? as all her edifices have crumbled into dust, save the colossal column that still frowns down upon the scene of ruin. Yet Alexandria possesses many objects which may incite and reward the search of the antiquarian. But in these pursuits my enthusiasm is over; or, if ever to be reawakened, it must be by such asso-

ciations as have stirred my spirit in Italy, or by such as are now urging me on to the shores of Syria. I tried to kindle up some spark of interest in the recollection of the Cleopatras and Antonys and Cæsars, and even invoked the shade of the Macedonian hero, whose dust lay mingled with the dust I was treading on. But in vain I laboured to get up an emotion; and my companions, as impassive as myself, required no intreaty to proceed on our voyage. We therefore, after three days' stay, embarked in a kangia (a kind of canal boat), with a low cabin, sufficient to screen us from sun and shower, upon the canal which has been made or restored by the present ruler of Egypt, and which, skirting the Lake Mareotis, is united to the Nile at the town of Rhamanieh, about thirty miles above Rosetta. We arrived there the next day, and hiring another boat, better formed for the wider channel of the Nile, began to ascend the river, by sail and oar and tow rope, according to the exigency of the hour, with a crew composed of a Turkish rais, or skipper, and five Arabs. I like not to dwell upon the discomforts of this navigation; the boat was alive with myriads of fleas and bugs, as well as of other still more disgusting vermin, from whose inroads no precaution could preserve us. These familiar companions, though odious to us, were, I am convinced, not unwelcome to our crew, whose idle hours seemed agreeably occupied by the inexhaustible *chasse,* which was always ready at hand in the covert of their woollen garments. There is nothing grand or pretty in the scenery of the Nile. At this season it flows deep between cliffs, composed of compacted mud and sand. Its course is rapid, but broken by banks and shallows, and its average depth we calculated to be not more than six feet upon a breadth of half a mile. From the boats' deck nothing can be seen of the country, save at times collections of black tumuli, to which the eye is attracted by a few scattered palm trees rising amongst them, but which on a nearer approach prove to be the dwellings of the miserable Fellahs, constructed of the earth on which they are placed, with which short straw is mingled and trodden in by the feet of men. The mass is then shaped into rude bricks, and dried in the sun. These owe their tenacity solely to the straw, and, unless protected from the weather, soon return to their original earth. Whole towns may thus, by a few days' rain, be melted away. These villages are perched upon every rising ground on the margin of the river, and are insulated during the season of inundation. At one of these, where we landed, every third structure was a high cone of narrow base, formed of pots of earthenware piled upon each other, cemented together with mud, and inhabited by multitudes of pigeons. These birds are kept for their manure, which is used in the culture of melons, and in the fabrication of nitre. They descended in crowds upon our deck, and alighted like ducks or gulls upon the water around us, whenever grease or the washings of our culinary utensils were thrown overboard. In our progress up the river we hauled nightly to the shore, and remained moored in the morning till the Etesian wind arose, which came in generally

about ten o'clock. I had thus the daily opportunity of walking many miles in advance of the boat, passing multitudes of the Fellahs, with their haggard families, who were engaged, with the help of buffaloes, working rude machinery, in raising water from the Nile, for the purpose of irrigation. Being generally alone, I sometimes felt a little odd as I encountered these crowds, and noted the wild and wondering gaze which they fixed upon my European complexion and dress. But I was slightly, though secretly, armed, and took care to betray no fear or suspicion of evil, but returned their gaze with steady composure, and found that they invariably blenched from my eye. I have been since informed that I was exposed to a danger from which other travellers, and very recently, had not escaped with equal impunity. But neither on my road hither, nor since my arrival here, have I (except in a single instance) suffered either injury or insult; though I lounge away many hours a day through these crowded streets, and jostle quietly out of my way the listless Turk, who never moves, if he can help it, and stares with solemn astonishment at any movements quicker than his own.

After four days' navigation we arrived at Boulak, the port of Cairo, from which it is two miles distant, after having passed, and viewed with intense interest, the margin of that desert, which here, limited by the waters of the Nile, extends westward, with little interruption, to the Atlantic, and eastward and southward to the Indian Ocean. It is impossible to look at this mighty feature of nature without awe. The art of navigation has conquered, as it were, the vastness of the ocean, and familiarized its terrors. But who can tame the desert, or dare, unappalled, its immeasurable solitudes? A few skilful seamen, in a frail bark, can make the fiercest tempests of the deep the ministers of their purposes. But the strength of caravans, nay, of whole armies, is whelmed without a struggle beneath the sandy whirlwind. We have learnt to "draw out leviathan with a hook," but who can enchain the Bedouin? Soon after our first view of the desert, we descried, against the horizon, the three great pyramids, and had the first experience of the power of vision which is enjoyed in the transparent atmosphere of Egypt. They seemed to start up at once to sight; their brilliant whiteness unmellowed by intervening air, and their enormous outline triumphing over the universal laws of perspective. Such as they then appeared, such they continued to appear during two days' approximation, and such and no more was the impression of their magnitude, when I afterwards stood within their broad shadow. After being a few hours delayed by the custom-house, which is managed and farmed by Copts, who profess christianity, and will not labour on the Sunday, except they are paid for it, we entered Cairo, escorted by a renegade Scotsman, who had introduced himself to us at Boulak, and assisted us in our negociations respecting our baggage. This man, it seems, was a hospital assistant in the ill-starred expedition under General Fraser, was wounded, made prisoner, and, accord-

ing to his own account, *forcibly* initiated into Mohammedanism. He has risen to the rank of Effendi, and wears, as the ensignia of office, a gorgeous inkstand, pendant from his neck. He has put us in possession of a house lately depopulated by the plague, where we have *monté menage*, with our travelling gridiron, pot, frying-pan, teapot, and tea kettle, as our *batterie de cuisine*, and our light mattrasses as the rest of the furniture—a raised seat, or divan, running round the hall, and superseding the necessity of chairs. I am now in a city bearing evident marks of a great metropolis. Very closely built, the streets being generally as narrow as those of Alexandria, it yet covers a great extent of ground, and contains, it is said, eighty thousand inhabitants. It is under a rigorous military police, and the prompt and uncompromising severity of the government crushes at once all incipient disturbance. The division of the city into *regions*, surrounded by high walls, with gates always guarded, which, being suddenly closed, cut off all inter-communication, facilitates this purpose, and illustrates the maxim, "*Divide et impera.*" The architecture is superior to any remaining in Alexandria. Richly-wrought portals, such as, in arch and ornament, we should call in England Gothic or Norman, are frequently seen; and there are some remains, of apparently great antiquity, as decidedly of that style of architecture as are the ruins of any of our ancient abbies. It is Clarke, I think, who describes a church, built under Justinian, in the island of Cyprus, as of the most perfect style of Norman building;—setting at rest, I should say for ever, the long vexed question of the origin of the pointed arch. There are a few wide streets, but the greater number are, as in Alexandria, covered and crowded beyond measure: Charing Cross at its full tide is not comparable to them. Here and there, as at the approach to a mosque, the passages widen, and the various ingredients of the confluent mob become separate and distinguishable. The eye has then the power of gazing at, and admiring, the polished marble, and richly-gilded façades of these buildings, and of looking upwards to their slender and beautiful minarets. But the glance of the Frank must be rapid, and without a pause, as the dogs of the country are said to drink of the Nile; for an insult would certainly be the fruit of protracted observation. You may suppose that we did not long delay to pay a visit to the pyramids. They are about three hours distant, on the opposite or left bank of the river. At about two miles from the walls we passed through the ruins of old Cairo; but, except some immense cisterns, which go by the name of Joseph's granaries, and the famous Nilometer, which is now so encumbered with mud and rubbish that we could scarcely descry it, we saw nothing worthy of observation. Our donkies were passed, by swimming, over the river, which we crossed in a ferry boat. We then wound our way over a great and cultivated plain, lying between the Nile and the desert, which was intersected by long stripes of water, the yet unevaporated relics of the last inundation. As we approached the pyramids, the rich black mould

beneath our feet changed by degrees to a blowing sand, and the terrein began to rise too rapidly for our humble cavalry. Still ascending, the rock began to peer out through the diminishing sand, which disappeared entirely before we arrived at the foot of the great pyramid. This amazing monument of misdirected power is built of great blocks of calcareous stone, each about four feet long by three in height and thickness, and so disposed as to form steps, by which we ascended to the top, after a severe effort of twenty minutes. The obtruncation of the pyramid, which is scarcely perceptible when standing at its base, forms, above, a plane of twelve or thirteen paces square, whence the eye can range around without limit. On returning to earth, we entered the interior by a passage four feet high and three wide, which descends for about forty paces, in an angle of thirty degrees with the horizon. It then ascends with a similar angle, and terminates in a chamber of thirty feet in length and twenty in height, wherein is a very large Soros: this chamber must be nearly in the centre of the pyramid. Returning, another passage leads to a second, but smaller chamber, which, by the dim light of my taper, seemed hewn out of the living rock. I had left my companions, and was groping my way downwards, preceded by a single Arab, bearing a light, through a narrow passage, when I was suddenly seized by my guide, and an accomplice, who had been dogging my steps. A rapid and well-directed blow took effect upon one of them, who disappeared from before me, and I heard him fall heavily into what must have been a fatal depth, on one side of my path. The other wretch I could hear, for some moments, moving quickly away: I did not chuse to follow him, but retraced my steps, and was glad to recover my companions. There can be little doubt that robbery, and perhaps murder, was intended; as, a few days afterwards, an English gentleman ascending this pyramid, separate from his company, was assassinated and stripped by some of these Bedouins.

I will close this short notice of my visit to these imperishable and mysterious monuments, by one remark.—Whatever may have been the original purposes for which they were built, it seems certain that their scite and form and proportions were determined with some reference to astronomical considerations. "Le coté de la base de la grande pyramide," says Dupuis, as quoted by Volney, "est égale juste à un stade Alexandrin, (684 pieds, 9 pouces, de France,) et exactement à la cinq centieme partie d'un degré du cercle terrestre. Ses pans sont disposés sous un angle tel qu' a l'entrée du soleil dans les signes equinoxiaux, son disque parait placé au sommet, pour le spectateur à la base." The sides, as nearly as I could ascertain by a pocket compass, face exactly the cardinal points. It is not reasonable to suppose that such peculiar astronomical relations were the result of mere chance. The mass, as it now exists, is probably an incrustation of a natural mountain, trimmed into the shape of the required nucleus, and quarried within, for the double purpose of forming interior apartments,

and of procuring the hewn stones of the exterior structure. The appearance of the second chamber, which, as I before stated, seems to have been excavated in the living rock, confirms this opinion. Had this chamber been *built*, the nicest manipulation could not have concealed the sutures of the stones. They are very visible in the principal and loftier chamber, and in the passages leading to it. That the neighbouring sphynx has been shaped out from an original amorphous mass, there can be no doubt. The transverse stratification, inclining about thirty degrees to the horizon, is visible across its whole bulk. I am not aware of the existence of any authentic account of the interior of this pyramid having ever been subjected to very rigorous examination. It is said that a well, nearly choked with rubbish, has been recently discovered. I did not see it, but it is possible that my traitor Arab there found his resting place. The task, "terebrare cavas uteri et tentare latebras," of this riddle of three thousand years, or more, may be perhaps better prosecuted through this well, than by any other direction of search.

I returned late in the evening, and heartily tired, to my lodgings. Our host, the renegado Scot, received us. From this man, cold, shrewd, and observant, I have got some insight into the strange state of things around me. I will endeavour to compress his information, and my own observations and reflections, into as small a space as possible, for I am ashamed of the length to which this letter has already extended. Here is a country which was once, as is evident from her monuments, even if history were altogether silent, a mighty empire. Six hundred years before Christ, while she was yet in the zenith of her grandeur, it was pronounced by the prophet Ezekiel that she should be, in a few years, utterly overthrown, and that though she should be afterwards in some measure restored, "she should continue for ever a *base* kingdom." It is repeated that "she shall be the basest of kingdoms; neither shall she be exalted any more among the nations." Her annals inform us how literally this prediction has hitherto been fulfilled. The prophecy is the actual history of Egypt, down to the present day. Though the iron grasp of her semi-barbarous ruler has pressed her discordant atoms into temporary cohesion, they will probably fall asunder and be dispersed, when age debilitates, or death destroys, the hand which holds them. The ill-compacted ball of empire will hardly hold together under the shock of transmission to a successor. Mohammed Ali, Pasha, though bold and sagacious, is after all but a barbarian. He has encouraged agriculture, but he sweeps all its productions into his own garners, at his own price. He has urged his wealthier subjects to undertake manufactories, and lent them money to establish them; but as soon as they promise well, he takes them to himself, and is become the sole manufacturer of his empire. He has built moles, excavated harbours, and called all the elements of commerce into action; but no one buys or sells but as his factor, or under his special license, and he is now the sole

merchant. His most extraordinary plan, however, (resembling what was accomplished by Joseph for Pharoah,) is to become the sole proprietor of the land. Whenever he can, by persuasion or threats, obtain the consent of the owner of the land, he orders it to be valued; and, paying the computed rent in the form of a perpetual annuity, becomes in his own person the lord of the soil. If he lives to complete all these projects, he may say with more truth than was said by Buonaparte, "L'Etat c'est moi." But if, as is more probable, the power which he has acquired, and thus strives to maintain, shall perish with him, his works will likewise perish, and Egypt will relapse into her proverbial darkness. It is true that the Pasha has not been wholly negligent of other reputed means of modernizing his empire; and, among these, he has protected and even established schools of primary instruction. But I am so old fashioned in my notions, as to withhold my faith in the miraculous efficacy of education. Its miracles are in general the most accredited by those who believe in no others, and my own experience has convinced me, that it is a weapon of mischief, oftener than an instrument of good, when it is not preceded and directed by moral and religious discipline. I am afraid that many a victim of this untempered power of good and evil may turn upon his instructors, and address them in the words of Caliban to his master:—

> "You taught me language, and my profit on't
> Is, I know how to curse. The red plague rid you,
> For teaching me your language!"

Of these schools one in Cairo is under the directions of some Moravian missionaries—truly apostolical men in all things but success—yet hoping against hope, and awaiting in resignation God's good time for beginning the work of regeneration in this benighted land. Of all the principalities and powers arrayed against Christianity, I conceive that Islamism is the most unassailable; and that, for the very paradoxical reason that it approximates too much to the better faith in its broader principles of belief. In essaying to convert the idolater, his common sense is readily won to the general truth of the unity of God; and his teacher, strengthened in influence by the first success, advances with better hope to the enunciation of the more mysterious doctrines, and goes on, conquering and to conquer, till every obstacle is overcome. But the disciple of Mohammed has been in long possession of this primary, and to him sufficient, doctrine of the Unity. You cannot *pre-engage* his reason on the side of our mysteries; you must lead him to the diligent study of the record; and you must teach him to compare, and combine, and to find the truth through the road of long induction,—or you must work miracles as your vouchers. The poor Moravians are somewhat aware of these discouraging views; but are content, until a better opening is offered to their efforts, to direct them to the humble office of educating, although debarred by the strict injunctions of

the Pasha, from evangelizing, the rising generation. I found them superintending a mixed assemblage of Turkish, Greek, and Coptic children, who were reading the Old Testament in their several tongues, and one class, consisting of ten, *in our own English!* The state of morals in this unhappy country, as painted by these amiable men, and as even discoverable by the passing glance of a traveller, is desperate, in an extreme unknown to the most profligate part of Europe, and unimaginable to any one who has not seen it. Honour and virtue have not a name, shame has no blush, and vice of every horrid kind walks abroad unveiled and unabashed, and finds none who are not equally her slaves. The whole mass of society lies rotting in one broad level of homogeneous corruption. Yet, even in Egypt, the seeds of change are spread around, and are germinating. The unwilling eyes of the people were, in some degree, though by compulsion, opened, at the French invasion, to the greater advance of Europeans in military skill and in the arts of life; but when England came in, with her fleets and armies, and overthrew the French usurpation, those eyes acknowledged gladly the more auspicious superiority of the victor, and paid willing homage to the salutary eminence by which they had been befriended. From admiration, which might have passed away, the genius of the present ruler went on to imitation, and fixed the fleeting impression. The blind, and blinding, belief in oriental greatness was removed out of the way of improvement, and the people began to compare themselves with Europeans, and to take shame at the contrast. They now interest themselves in European news—they enquire—they even read! My renegado friend declares that he no longer knows the people, whom he found here twenty years ago. If to know his ignorance be the first step to knowledge in man, that step is certainly accomplished, and it is assuredly the most difficult one. The next step is, however, the most painful. What loathings of the present, what despairing of the future, must, by turns or together, attend the first efforts at emulation, immeasurably distant as they now appear behind us! what a host of obstacles within view—what a host yet beyond their horizon to be apprehended. It were better perhaps that in "ignorance sedate" they should "roll darkling down the torrent of their fate" than to undertake a change, of which the only *certain* result is an aggravation of a present, and nearly intolerable, misery. You will take these speculations, written in confusion, in sickness, and in danger, for what they are worth. I shall write to you no more from this Pandemonium. My next, if I escape from it with life, will be dated from Palestine. A. A.

REVIEW.

Researches and Missionary Labours among the Jews, Mahommedans, and other sects, during the years 1831—4. *By the Rev. Joseph Wolff.* 8*vo. pp.* 523.

With the labours of Mr. Wolff, himself formerly a Jew, among his Jewish brethren scattered over various parts of Europe, Asia, and Africa, the accounts which he has already published, have rendered many of our readers more or less familiar. The volume now before us relates the continued labours of the same individual in Asia, from Hindoostan and Cashmeer, to the Arabian desert and the Mediterranean, during the years 1831, 2, 3, and 4.

It is scarcely consonant with our plan to notice the reports of ordinary missionaries, valuable as they frequently are, because they are sufficiently dwelt upon elsewhere: but the present volume is of a character very generally interesting, and is capable, from the qualifications of its author, from the peculiar habits of the people among whom he travelled, from his opportunities of eliciting their real character, and zeal in taking advantage of such opportunities, and from the almost childish simplicity with which the whole is narrated, of affording both passing amusement and permanent instruction, and we think deserves to be both generally and carefully read.

Mr. Wolff left Malta for Cairo, whence, recrossing the Mediterranean to Adalyah, he passed through Asia-Minor and Armenia, along the southern boundary of the Caspian, by Teheran to Bokhara and Balk. Thence he proceeded into the Punjaub territory; and having obtained the permission of Runjeet Singh, visited the city of Cashmeer. From Cashmeer he descended the country to Calcutta, and skirting the peninsula of Hindoostan, left Bombay by sea for Suez, whence he returned to Malta after an absence of about three years and a quarter.

The subjects towards the elucidation of which the attention of Mr. Wolff was particularly directed, while performing the above journey, were the religious tenets and observances of the various tribes whom he visited, and the principal object of his mission was the discovery of those tribes of the Jews who were scattered at the Babylonish captivity.

But although the principal end of Mr. Wolff's journey forms of course the subject of the greater part of his volume, it contains besides, a considerable quantity of incidental information concerning the population, dialects, modes of expression, habits, philosophy, &c. of the eastern nations.

Mr. Wolff considers it as highly probable that the ten lost tribes are dispersed around Lassa and in China. His success as a missionary he regards as considerable; but as he never stayed very long in any one place, it is to be feared that many of his converts will relapse; and indeed we cannot understand why, when on more than one occasion a door was opened

to his exertions, Mr. Wolff did not remain a little longer to take advantage of it.

There is one point, somewhat neglected, but of considerable importance, which the whole tenor of Mr. Wolff's volume makes abundantly manifest; it is, that the office of *missionary* to the east is one of no ordinary difficulty; that it requires a man, not only inured to hardships, and capable of enduring bodily fatigue, but urged on by persevering zeal, and guided by a sound judgment—qualities not often combined;—learned, not only in the faith which he professes to teach, but in all the subtleties of that which he comes to subvert, and sufficiently exercised in argumentative habits to enable him to apply his knowledge when suddenly called upon, and to convince, so far at least as it is permitted to human reason to convince. "I would advise no one," observes Captain Riley, in one of three admirable letters written by him to Mr. Wolff, "I would advise no one to undertake religious argument with either Hindoo or Moosulman, particularly the latter, who has not given his attention to all the concerns of their persuasions. Some have done so, and have failed, thereby affording their opponents new accession of strength; and it is surely unreasonable to suppose, they or any other people will embrace a new religion, until they are convinced of the fallacy of the old." p. 296.

It is impossible not to be pleased with the simple and unaffected manner in which Mr. Wolff has related his labours and sufferings; and by constantly declaring his true character and purpose, sometimes to his great apparent risk, he has shewn that the declaration of the true character when travelling, is on the whole safer than the assumption of a false one; and that in the east, as in the west, honesty is still the best policy.

One slight objection, and we have done. Mr. Wolff's views upon the fulfilment of prophecy, and on the near approach of certain great events, are well known to be peculiar to himself and to a very limited number of Christians. Should he not be extremely cautious, more so than from his book he appears to have been, in declaring those views to his newly-converted hearers? Should those views prove false, and views at least equally well supported have not seldom proved so, will not the probability be, that the undiscerning hearers will refuse their assent to the whole?

POETRY.

SPECIMEN OF A POETICAL SUMMARY OF HISTORY.

(To the Editor of the West of England Journal.)

Mr. Editor,

Being, as the parent of a large family, anxious to inform the opening minds thus committed to my charge, and feeling it a very interesting part of this duty to impart to them a comprehensive view of history, it has often occurred to me that a fair use has not hitherto been made of poetry,

as the medium which most readily interests the imagination, and most permanently impresses the memory. Poetry, indeed, at its first origin, in almost every nation, appears to have been principally employed for these memorial purposes. The first histories are very frequently only the strains of the minstrels, and even the first laws were invested in a metrical dress. In modern times, indeed, we have occasionally rhyming lists of names and dates; but this surely cannot be called poetry, nor does such a system at all avail itself of the great principle, which gives to poetry its most powerful grasp over the faculty of memory: this will be found to depend on the pregnant brevity which always belongs to the true language of poetry, and by which a single allusion, especially when it presents any thing like a picture to the mind, instantly calls up an extended train of associations. With these views it has been my object to trace out what may be called the leading pictures of history, and to exhibit them, as well as I was able, in a poetical form. I have found the practice answer in my own private experience. I do not mean that history can be *originally learnt* by reading a few lines of such verses as the following; but I think that it may be thus most engagingly and most effectually impressed on the memory, whenever it has been once read in the ordinary method.

I send you, as a sufficient specimen of my proposed method, my poetical view of that most important period, the first century of Mahometan conquest, which, if you think it at all applicable to the purposes of your Journal, is much at your service, From yours sincerely,

PATER FAMILIAS.

MARCH, 1835.

FIRST CENTURY OF MAHOMETAN CONQUEST,

From Hegira, 622, to Defeat of the Saracens by Charles Martel, 732.

In Hera's cave what mingled visions roll,
Son of Abdallah, o'er thy youthful soul!
Enthusiast[1] half, thou deem'st some angel voice
Bids thee in purer views of truth rejoice;
Yet more ambition draws thy mind away,
To bend those visions to thy lust of sway.
Vain dreams at first—thy fond Kadijah's care
Gives thee in vain her ample wealth to share;
Few are thy converts, hostile is thy race,
And kindred Koreish[2] drive thee from thy place.

[1] Mahomet seems in early youth, before ambition led him to become an impostor, to have been rather an enthusiast, and sincerely to have believed himself employed to overthrow the idolatry of Arabia, by proclaiming the great truth of the divine Unity. It was his habit to retire for meditation to the solitary cave of Hera, where he professed, and perhaps himself believed, that he received Divine communications.

[2] Mahomet was of the illustrious Arabian tribe of Koreish, his wife Kadijah a wealthy widow; she became the first of his converts. Their number was long

Yet destined thou; her web the spider throws
To skreen Thor's sheltering cave from prying foes;[3]
And e'en thy flight[4] shall mark the date of time
Through many an age and many a distant clime,
Medina,[5] Ansars, Beder drench in gore
Thy Mohagerian's Mecca to restore.

At length 'tis entered—Caaba's fabled fane[6]
Must Kebla of the Moslem's prayer remain.
Islam[7] prevails—through broad Arabia now
Vanquished in Honain's flight her idols bow;
Through poison drains th' impostor prophet's life,[8]
Still wide and wider spreads the victor strife

CONQUESTS OF SYRIA, PERSIA, AND EGYPT.

Khaled the sword of God triumphant wields
O'er Balbek's sands, and Syria's wasted fields;[9]

small, the earliest and most distinguished were his freedman, Zeid, his cousin Ali, son of Abu Taleb, and his constant friend, Abubeker. The rest of his tribe resisted and expelled him from Mecca.

3 While he fled from Mecca, pursued by his enemies, he took shelter with his friend and only attendant, Abubeker, in the cavern of Thor. It is stated, that soon after he had entered, a spider spun her web across the opening: his pursuers were deceived by this accident, concluding that no one could recently have disturbed the solitude; they therefore passed onwards, and missed their intended prey.

4 This flight of Mahomet forms the great epoch of the Hejira, adopted by all Mahometan nations; it corresponds with 622 of our æra.

5 At Medina, to which city Mahomet now retired, his cause was embraced by a considerable party; these were called Ansars—auxiliaries; the fugitives from Mecca were denominated Mohagerians. A warfare ensued between these allies of Mahomet and the Koreish of Mecca; it was protracted for about six years. At Beder one of the earliest and most distinguished battles was fought.

6 The Caaba was the ancient national temple of Mecca. When Mahomet and his followers undertook the siege of Mecca, he was permitted under a truce to enter this temple to offer sacrifice. During this visit he won many of the Koreish to his cause; and the partizans of idolatry, now reduced to a minority, were soon after obliged to yield to him the town. He adopted their long venerated temple as the holiest spot of his new faith, and appointed it as the kebla or point towards which every Mahometan offers his devotion: this took place in 629.

7 Islam is the general denomination of the Mahometan faith. After the submission of Mecca, many of the other Arabian tribes still retained their idolatry and hostility to Mahomet. What was called the war of idols ensued, which was terminated by the decisive victory of the pseudo-prophet at Honain, in 632. All Arabia then yielded to his creed.

8 Soon after this decisive success, the victor's life sunk under a lingering illness, said to have been occasioned by poison administered by a Jewess.

9 Even before his death, his generals had invaded the Syrian province of the eastern empire. Khaled, the chief of these, was called the Sword of God; he carried victory from the Red Sea to the Euphrates. Jerusalem was captured by the second caliph, Omar, 637.

Till Sion, trembling on her rocky throne,
Anew shall desolation's horror own.
Next Persia feels thro' all her realms the blow;
Sinks Yezdegird thy jewelled banner low.[10]
Egypt accepts the yoke,[11] and Amroo's powers
Their crescent raise o'er Alexandria's towers;
And Omar's flames within those walls devour
The spoils of learned ages in an hour.[12]
So in twice nine short years from that of flight[13]
Rolls on that flood of empire's headlong might.
Mourning his narrowed sway, and lower'd pride,
Grecian Heraclius bow'd his head and died.[14]

FIRST SUCCESSION TO THE CALIFATE.[15]

Meanwhile three caliphs fill the prophet's place
Friends through his course, but aliens to his race.

[10] In 636, Yezdegird, grandson of Chosroes, and then sovereign of Persia, was overthrown in the battle of Cadesia by the forces of Omar. The standard of the Persian monarchy, covered with jewels, is particularly specified as among the captures.

[11] Egypt was invaded by the troops of the same caliph, under Amroo, 639. Alexandria submitted to his arms at the close of the next year.

[12] Every one is familiar with the story of the destruction of the Alexandrian library by the bigotry of the caliph.

[13] All these conquests were achieved, and Syria, Persia, and Egypt, added to the Mahometan dominions within the first eighteen years of the Hejira.

[14] Heraclius, the Grecian emperor, is said to have expired of mortification, when, in the beginning of 641, he first heard the recent capture of Alexandria.

[15] The first caliphs were not of the blood of Mahomet, and chosen to the exclusion of his cousin Ali. Abubeker, his early convert and steadfast friend, and the father of his latest wife, Ayesha, succeeded to her power on his decease in 632. After two years he died, and Omar, another of Mahomet's early followers and also father of another of his wives, was elected in his place; his reign lasted till 644, when Othman, who had been the secretary of Mahomet, became the third caliph, and the hereditary claims of Ali were still suspended. Nor did this kinsman of Mahomet, although his claims were strengthened by the influence of his wife, Fatima, Mahomet's favourite daughter, obtain the seat of power till 655. Hence has arisen the principal schism which has divided and still divides the Mahometan world; the largest party, the Sonnees, acknowledge the legitimacy of the three first caliphs; the other sect, the Shiahs, adhering to his hereditary claims, recognise Ali only. The Turks belong to the former, the Persians to the latter sect. The claims of Ali were resisted by Moawyiah, of the house of Ommias; he was the son of Abu Sophian, long the leader of the Koreish against Mahomet, but, after the submission of Mecca, a convert to the victor. Amid these dissensions, three enthusiasts believed that the only way of restoring peace to the Mahometan world, would be the assassination of the two competitors already named, together with Amroo, the victor of Egypt, who had also pretensions. But the blow directed, in the mosque of Cufa, against the life of Ali, alone succeeded, and Moawyiah derived the benefit. This head of the Ommiad line became caliph, 661, and procured the abdication of Hassam, son of Ali, and grandson of Mahomet.

First did the young Ayesha's sire succeed,
Then Omar, and next Othman claims the meed.
Ali, who near to him in blood allied,
Calls Fatima, his dearest daughter, bride,
Yet mounts that seat but fourth, and murder's thrust
In Cufa's mosque soon bowed him to the dust.
Him as their murdered saint the Shiahs own
And Persia's thousands still that blow bemoan.
Yet now deserted must his son resign
The sacred title to the Ommiad line,
First the faith's bitter foes in hour of need,
But since keen champions of the conquering creed.

PROGRESS OF CONQUEST UNDER THE OMMIAD CALIPHS.

They subdue Africa and Spain, are repelled from Constantinople, invade France, but are defeated by Charles Martel.

Westwards o'er Afric's shores they pour afar
The all-prevailing tide of Moslem war.
Mark in th' Atlantic flood how Akbah brave[16]
Spurs his fierce steed, and blames the bounding wave,
Yet the wild Moorish queen maintains the field—
And Berber's arm, though Goth and Grecian yield.
Within a century since the prophet fled
O'er Calpe's straits his victor bands are led,[17]
Whose rock preserves the chieftain Tarik's name
While Boetis swallows Gothic Roderic's shame.
Yet still Asturia's hills preserve the free,[18]
And shield that mountain nymph, fair liberty.
There yet beneath Pelayo's sword remain
Germs of the powers revived of Christian Spain.

[16] From 665 to 690, Akbah, the general of the caliph Moawyiah, carried his victories across Africa, till arrested by the Atlantic. He spurred his horse into the waves, and raising his eyes to heaven, exclaimed, "Had not my course beeen stopped by this sea, I had gone on conquering and converting the unknown lands of the west." Carthage, however, only submitted to Hassam, 698. The native Berbers, however, under their Queen Cahina, resist, and at first obtain partial success in the struggle, but are partially subdued, 709.

[17] In 710, the 92 Hegira, the Arabs invaded Spain. The promontory, where they landed, took a new name from their chieftain, Gebel, al Tarik, (Gibraltar) the rock of Tarik. He defeated Roderic, the last king of the Spanish Goths, in the battle of Xeres, near Cadiz; and this defeated monarch, in his flight, was drowned in the river Boetis, or Guadalquivir.

[18] In Asturia, however, a remnant of the Spaniards and Goths rallied under the banner of Pelayo, and created a small but independent kingdom, which subsequently expanded itself, and became the source, whence other Christian states which formed on its borders. The Spanish dominions of the Arabs were thus gradually reduced, and, about seven centuries after their foundation, finally extinguished.

Constantinople too still checks the flood,[19]
Quenching her vengeful fires in Arab blood,
Vain too the fury of thy fierce advance,[20]
Bold Abderahman, through the plains of France,
Europe her homes and altars saved from thrall,
May thee, brave Charles, her great deliverer call,
Hammer of war thou won'st thy title well
On Tours broad fields when Arab myriads fell.

[19] Constantinople effectually checked the progress of Arabian victory; it stood two sieges, 675 and 718. The Arabs suffered their greatest loss from the effects of the Greek fire employed by the Constantinopolitans.

[20] Ten years after their invasion of Spain, the Arabs, in 721, advanced into the south of France, establishing themselves in Languedoc; and the fate of entire Europe appeared to tremble in the balance, when after another ten years they again marched forward in 731. Europe was, however, effectually saved by their complete defeat and destruction by Charles Martel, really the sovereign of France, though nominally only maire du palais under the last of the rois fainéants of the Merovingian race.

EPITAPH ON AN INFANT.

We saw thy gentle face and tender form,
In sorrow heard thee weep thy helpless cry,
Thy bright eye meekly look'd upon the storm
It could not brave:—thou did'st but live, and die.

No words,—but winning smiles and melting tears,
Our deep love kindled, and strong pity drew;
In quick succession came our joy and fears,
Till our sad loss, and thy great gain we knew.

As the bright star rising at early dawn,
Beams on this dark cold world, then swift retires,
Ascends, unseen, but sheds its rays withdrawn,
Through heaven's vault with unextinguish'd fires;

So earth's fair child, just born to sin and woe,
Shines on departing night, is hid in day,
Guiltless, as saved by grace, leaves all below:
The Lord of glory bade it come away.

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PART II.—LITERATURE.

ESSAY ON THE WRITINGS OF HESIOD,

PRINCIPALLY COMPILED FROM SOME MS. LECTURES DELIVERED AT OXFORD BY THE REV. J. J. CONYBEARE, PROFESSOR OF POETRY.

Communicated by his brother, the Rev. W. D. Conybeare.

ON THE THEOGONY.

(Concluded from p. 89.)

At verse 521, the brief allusions and dry catalogue of mythical names, which have occupied so large a portion of the Theogony, are succeeded by more detailed narratives of the story of Prometheus, and of the war of the Titans, and of Typhœus, against Jupiter, and the description of Tartarus. The first portion has indeed still very little of poetical merit, but to the latter the fame of Hesiod, as one of the most distinguished of the early poets, is principally to be ascribed.

1. Prometheus is introduced in connection with the genealogical series, which the poet has up to this point pursued, among the progeny of Iapetus and Clymene. His story may be very probably conjectured to have had its original foundation in an allegorical representation of the inventive power of human sagacity as applied to the arts, of which the use of fire is the most essential and universal requisite; and by Pandora and the evils which followed in her train, we may perhaps conceive the luxuries and evils introduced by this artificial state of society to have been indicated. But whatever may have been the original intention of the legend, it had become in the time of Hesiod overlaid and obscured by details merely introduced as fabulous embellishments of the narrative.

Hesiod first describes Prometheus as bound through the wrath of Jove, by inextricable fetters to the midst of a column, while an eagle with outstretched wings perpetually preyed on his liver; but from this state of penal infliction he was at length delivered by Hercules, through the permission of Jupiter, who preferred the glory of his son to his own vengeance. The causes of Jupiter's wrath are then explained. The first of these is marked by all the *bizarrerie*, which so often characterises the early mythology of half-civilized nations. In the division of a bull sacrificed at Meconè (the ancient name of Sicyon) Prometheus distributed the produce into two parcels; the one containing all the flesh and entrails wrapped in the skin, the other, which was much the largest, held nothing but the bones shrouded in an envelope of suet; he offered the choice of these to Jupiter, who readily fell into the snare, chose the larger heap, and stripping aside the fat with wrath observed the bare bones, which he had thus made his portion. Can we conceive that this rude fable may be intended to designate, that the wisdom Προμηθεια of man sometimes may be perverted even in attempting to deceive the deity? Irritated by this fraud, Jupiter withheld from the wretched race of man the gift of fire, but was again circumvented by the arts of Prometheus, who surreptitiously concealed in the hollow of a reed sparks of the indispensable element, and reconveyed it to man; thus by his signal benefit to the human race drawing upon himself the fearful vengeance of the majesty of heaven. This monstrous fable seems in itself pregnant with views destructive of the very foundation of religion, since it represents the chief of gods not as the bountiful benefactor but harsh oppressor of man; and we find accordingly that in a later age the genius of Æschylus, in embodying this fiction into the most remarkable and powerful drama among the remains of the Greek theatre, exhibited to the "*fierce democracy*" of Athens, the strongest ideal portrait of stern oppression and arbitrary tyranny in the character of the supreme majesty of heaven, while in the unhappy victim Prometheus he represents the perfect image of a generous and determined patriot, bearing with unflinching constancy all the inflictions of his tyrant foe, above whom he rises far superior in all the dignity of moral power. How such exhibitions could possibly be reconciled to any profession of religious worship for the being thus represented, it is indeed difficult to conceive.

But not only was Prometheus himself thus punished, but for the whole race of men a visitation of evil was prepared by the formation of Pandora, the origin of the female sex, "a fair defect," welcomed by their deceived minds as a blessing. This subject is also treated of by Hesiod, in the beginning of his "Works and Days" and two or three lines are in both places the same, but the general execution in that work is far more gracefully wrought. In the Theogony the poet most ungallantly represents the sex, as much such associates to laborious men as drones are to the industrious bees; and he concludes with some lines which may be cited, certainly neither as an

example of gallantry or poetry, but as a curious illustration of that rude and uncultivated period of poetical taste, which could thus tolerate the blending of a rude strain of coarse satire into the substance of a religious poem.

Ος κε γαμον φευγων, και μερμερα εργα γυναικων, &c.———603.

He who th' anxieties of wedded life
And women's ways perplexing, fain would shun,
Must lose, when worn by age, the tender care
That best supports its weakness; and his wealth,
If wealth be his, must fall to distant heirs
That wait his funeral, to divide the prize.
He who, by rare felicity, has found
A faithful bride, of well-condition'd soul,
But gains at best a checker'd life, half good,
Half evil. He again whose cruel fate
Has bound him to an ill-starr'd yokefellow
Of mind deprav'd, folds to his breast through life
A weary wasting curse; his heart and soul
Consuming, by an ill without a cure.*

Hesiod, having thus traced out the legends connected with the children of Iapetus, reverts in line 617 to the subject which in 507 had been broken off by the introduction of this genealogical episode;† namely, the deliverance by Jupiter of Briareus and his hundred-handed brethren, from the captivity in which Kronus had detained them, in order that they might assist him in his struggle against their old oppressor and the other Titans. Jupiter, having refreshed them with a banquet of nectar and ambrosia, addresses to them his request; and Cottus replies with warm expressions of his gratitude and readiness to join "ατενει τε νοω, και σωφρονι βελῃ," "with intent mind and prudent counsel," against the Titans as the common enemy; and as they rush to the field, each bearing massive rocks in all his hundred hands, and overshadow the enemy with three hundred darts discharged at once, they must have proved formidable allies. The description of the battle which ensues is undoubtedly among the most powerful

* This may perhaps remind us of a quaint but striking passage in Jeremy Taylor's Marriage Ring. "The wife of a bad husband is indeed in bad case, for her tormentor hath a warrant of prerogative. And the husband of a bad wife sighs while he sitteth abroad with his neighbours, for he remembereth that his objection lieth in his bosom."

† The manner in which these disjointed fragments are huddled together, seems to belong much more to the *patchwork* system of the ραπτων επεων Αοιδοι than to any thing which can be conceived to have been an originally regular composition, and the whole episode of Prometheus appears singularly mutilated and incomplete. We have no account of the nature of his connection with the race of men, nor can we discover whether the legend, which ascribed the origin of that race to his animated clay statues, had already been received in the age of Hesiod.

examples of ancient poetry, and is further remarkable as the prototype of the sixth book of our own Milton; we shall therefore subjoin a feeble but very literal attempt to translate this passage. But first we would observe, that the localities of the combat, the Titans being arranged on Mount Otheys, and the allies of Jupiter on Mount Olympus, sufficiently indicate Thessaly as the cradle of this legend.

678..... δεινον δε περιαχε Ποντος απειρων, &c.

O'er the wide waves rolls the dire clamour; earth
Loud echoes; ample heaven returns the roar
Trembling; and tall Olympus from its base
Rocks, with the charge of hostile deities.
Deep to Tartarian shades the tumult spreads,
Sharp tramp of hurrying tread, and sturdy strokes,
And war's wild uproar: while their hissing darts
Rush in alternate flights, and loud the shout
Rings to heaven's starry vault, from either side
In conflict closing. Now Jove checks no more
His fury, but his full-fraught soul o'erflows
With energy, and collecting all his might
He forth displays his power; and from high heav'n,
And from Olympus, rolls at once the blaze
Of rapid lightnings, and the thunders' peal;
While from his stout arms flash the sacred flames
Incessant. Earth in conflagration roars;
And mightiest forests crash around the fires.
The land dissolves, and boils the ocean wave
With fervent heat: the burning vapours round
Pursue the Titans through the realms of earth.
Immense the blaze to th' highest æther spreads;
And dazzling splendours blind the stoutest eye,
From the far-flashing lightnings; Chaos' self
The heav'n-enkindled conflagration feels.
Like seem'd it to the eye that saw the sight,
And ears that heard the crash, as though wide heav'n
And earth commingled in confusion lay,
And ruin, crush'd and crushing; such the noise
When gods meet gods in the rude shock of war.
The winds bare on their blast the dust, the storm
The pealing thunders, and fierce lightnings flash
The darts of mighty Jove:—the cry, the shout,
All the wild uproar of the fearful fight,
Raged in the midst of th' adverse ranks; for there
Was prowess proved in the stern deeds of war.

Powerful as the original of this passage undoubtedly is, it is still I think obvious, that it is strongly marked by the fault which perhaps most characterises a rude and early stage of poetical art; the excessive repetition of almost identical ideas, when any striking image possesses the poet's mind, an overloaded wordiness, and the absence of any attempt at compression

and condensation. In the note will be found the passages of Milton, which will admit the nearest comparison with the above.*

The Titans are at length hurled into the depths of Tartarus,

> As far beneath the earth as earth from heav'n.

A brazen anvil would, as Hesiod adds, occupy nine days and nights in falling through either space; whence Milton appears to have borrowed the idea of assigning this space to the fall of his rebel angels.

In this abyss the Titans are chained by Briareus and his brethren, who there keep watch and ward over them; and a striking description of their penal abode follows.

> Τον περι χαλκεον ερκος εληλαται ——— 726.
>
> Around a wall of brass is firmly fix'd,
> A threefold night aye hovers o'er the brow;
> While overhead the solid roots extend
> Of earth's vast plains, and the unfertile main.
>
> χασμα μεγ' ——— 740.
>
> 'Tis a vast yawning gulph—a year's full space
> Sufficeth not from the first gates to reach
> The solid soil; impetuous tempests rage
> Throughout, and whirlwinds drive from point to point.

* Par. Lost. b. vi. l. 205.—

> ——— Nor stood at gaze
> The adverse legions, nor less hideous seem'd
> The horrid shock; now storming fury rose,
> And clamour, such as heard in heav'n till now
> Was never: arms on armour clashing brayed
> Horrible discord, and the madding wheels
> Of brazen chariots raged; dire was the noise
> Of conflict. Overhead the dismal hiss
> Of fiery darts in flaming vollies flew,
> And, flying, vaulted either host with fire.
> So under fiery cope together rush'd
> Both battles main with ruinous assault,
> An inextinguishable rage; all heav'n
> Resounded, and had earth been then, all earth
> Had to her centre shook.

Milton is perhaps most superior to Hesiod, where we find the latter describing Jupiter as under the necessity of collecting and putting forth all his might for the contest; but the latter, when he introduces the charge of the Messiah on the rebel angels, adds,

> Yet half his strength he put not forth, but check'd
> His thunder in mid volley.

And although thunder and lightning are in both instances the divine weapons, yet in Milton we have none of the over-wrought descriptions of Hesiod.

Th' immortal gods themselves with awe regard
The fearful region—there the dread abode
Of gloomy night is veil'd with dusky clouds.
There, with unwearied arms and bending head,
Atlas the weight of heav'n sustains; and there
Meet day and night, and cross each other's path,
Treading with course opposed the brazen road.

In these lines we have evidently the traces of a rude physical system, invented to explain the most obvious of the astronomical phænomena, the interchange of day and night; after the luminaries had traversed their vast arch, extending over the earth and ocean, (considered as constituting a vast plain,) it was necessary to suppose a vast vacuity, extending beneath that plain, through which they might return from their western goal to their eastern starting post: hence the idea of Tartarus. Atlas, the mountain chain whose cloud-capt summits line the extreme horizon to the navigators of the Mediterranean, as we have already seen, became naturally represented as the support of the heavens;—its situation, in the extreme west, the point of descent to all the heavenly bodies, further associated with it the idea of descent to the infernal regions.

The next inhabitants of Tartarus, to whom we are introduced, are mythological personifications conceived with much power.

Ενθα δε νυκτος παιδες ——— 758.

Here Sleep and Death, offspring of gloomy Night,
Hold their dark dwelling-place, dread deities,
Whom ne'er the Sun beholds with cheerful ray,
Or when he climbs or when he stoops from heav'n.
All mild the one o'er earth and the broad waves
Of ocean speeds, sweet soother of mankind;
His brother's heart is steel, his soul of brass;
Each wretched mortal whom he once may grasp
He ever holds, and e'en the heav'nly train
Hate, though they fear it not, his power accurst.

The sovereigns and the dog of hell are next enumerated, but with little of poetical ornament; and the description concludes with the infernal river Styx, whose mansion is overhung by mighty rocks, and supported by silver columns, and whose streams contain a tenth part of all the waters of ocean. We have here a curious piece of mythology, as to the punishment of perjured deities, when Iris sent by Jove has brought to present to them these chill waters in her golden chalice as the sanction of their oaths. Should they violate it they must lay for an entire year, breathless and speechless, in a deep swoon, and pass nine more years in a succession of penal labours, before they can be restored to their place in the assembly and banquets of the immortals.

Here closes the description of Tartarus, as still preserved in this poem; but it is probable that many portions of the original composition may be

lost, for we find many evident signs of disarrangement, and four whole lines, 736 to 739, are repeated verbatim, 807 to 810, and the last of these lines also occurs in the Homeric poems.

A new subject is now introduced; a description of the monstrous progeny of the embraces of Tartarus and Earth—Typhœus, fearful with an hundred serpent heads, while to borrow the words which Milton seems himself to have derived from this passage :

"Every eye glar'd lightning, and shot forth pernicious fire,"*

and every throat sent forth every possible variety of horrid utterance—the lowing of the incensed bull, the roar of the lion, and the screams of whelps.

This monster, it seems, had employed all his mighty powers in rebellion against Jupiter, and had nearly succeeded in expelling him from his throne; but the victory ultimately remained with the latter. Their conflict and all its accompaniments of tumult and terror are described, though with considerable variety of expression, yet with such a general similarity of ideas to the former pictures of the Titan war, that to translate would scarcely afford any new illustration of the poet's style; we may except however a few lines, very remarkable in themselves and still more so from their close coincidence with a passage in the Iliad, Υ. 65, where Homer represents the gods who aided the hostile ranks of the Grecians and Trojans as themselves joining in the fight. The agreement of the two poets is such that it seems perfectly clear that one must have copied the other, and as the passage in Hesiod is much the shorter and simpler, and appears to contain the first germ of the ideas expanded, amplified, and ornamented in Homer; this has been very plausibly adduced as an argument, establishing a presumption in favour of the higher antiquity of the Ascræan bard. His passage is as follows.

Εζεε δε χθων πασα, &c.———848.

Boil'd the whole earth and heaven, the mighty sea
Lash'd its wide shores and roll'd its swelling waves.
Such inextinguishable tumult rose,
Beneath the shock of warring deities.
Pluto, dread monarch of the shadowy dead,
Trembled, and Saturn with his Titan band
Deep in Tartarian gulphs; so loud prevail'd
Th' inextinguish'd shout, and conflict dire.

The passage in Homer may be thus translated :

Δεινον δ' εβροντησε, &c.———Il. Υ. 65.

The sire of gods and men from heav'n above
Loud thunder'd, Neptune shook th' unbounded plain

* ————εκ δε 'οι οσσων
Θεσπεσιης κεφαλησιν υπ' οφρυσιν πυρ αμαρυσσε
Πασεων δ' εκ κεφαλεων πυρ καιετο δερκομενοιο.———829.

Of earth beneath, and tops of loftiest hills ;
The far-spread roots of Ida rich in springs
And every summit trembled, and around
The Grecian navy, and the Trojan towers.
Trembled the monarch of the shades below
And leapt in terror from his throne, and shrill
Exclaim'd; lest Neptune shaker of the earth
Should burst its wide foundations, and disclose
To th' eyes of men and gods his realms below
Dismal and loathsome, which e'en gods detest.
So fierce the shock when gods conflicting meet.

Typhœus is finally prostrated by the thunder of Jupiter, and driven to Tartarus ; at his fall his lightning-struck corpse communicates its fires to the earth, which flows around like tin or iron in the furnace. The whole of this fable has strongly the appearance of a physical mythos, intended to represent the principle of volcanic action ; and we find the later poets, Pindar and Æschylus, accordingly describing Typhœus as overwhelmed by Ætna, and the eruptions of that volcano as the result of his struggle. His descent from the embraces of Earth and Tartarus may, under this view, be explained as indicating that the source of volcanic action originates at the junction of the earth and the iufernal regions.

In the poem, as it has been handed down to us by the rhapsodists, another dry genealogical patch, consisting of little more than a list of names destitute of poetical ornament, follows. In this the offspring of Jove, by some dozen of his wives and mistresses are enumerated, but as these must be familiar to every student, and open no sufficient clue for the explanation of the allegories in which we may suppose them to have originated, we may well pass them over in silence. We here find also catalogues of the offspring of Neptune and Amphitrite, and Venus and Mars, with regard to whom we may observe, that as Hesiod appears ignorant of the matrimonial connection between Venus and Vulcan, though familiar to the authors of the Homeric poems, he seems to impute no scandal to their loves ; but though he thus denies to the god of the anvil the queen of beauty, he consoles him with Aglaïa, the youngest of the graces. The marriages of Hercules (after the happy accomplishment of his labours) with Hebe, and of Apollo and Oceanine, are then recorded : the muses are next invoked to sing the amours of goddesses with mortals, in which, besides the well known instances of Venus with Anchises, and Thetis with Peleus, we have several similar cases, but all too briefly and unpoetically treated, and too devoid of any kind of interest, to demand notice.

The conclusion, in which nothing is concluded, consists of an invocation, to commence a new song concerning the fortunes of illustrious women ; but although we know from the testimony of antiquity, that a poem of Hesiod on this subject once existed, supposed to be the original source which has furnished many of the heroines to the Greek drama, it has long been lost.

To bring our own remarks, which have already extended to a length far beyond that which we originally contemplated, to a conclusion, we will only subjoin a few words on the application of the mythology which we have been considering to the purposes of poetry. We have seen that this mythology at once divides itself into two great classes or periods, which we may distinguish as the Saturnian and Jovian ages. Now the mythi connected with the former of these periods, when not obviously referable to allegorical representations of physical causes, are enveloped in fables seeming to defy every attempt to give a probable explanation of their origin, and marked by a peculiar character of obscure and uncultivated wildness and horror. The materials supplied by this elder school of fiction appear eminently calculated to subserve the purposes of the sublime in poetry, and to impress it with a character of religious awe: for these fictions, whether we receive them in their allegorical or literal acceptation, will very generally be found to excite and sustain that intense elevation of mind, with which our nature ever prompts us to pursue objects invested in all the mysterious obscurity of remote distance and high antiquity. What competent student of classical poetry is there, who must not have experienced this feeling, while perusing the Prometheus and Eumenides of Æschylus?

The character of the second class of mythological fictions, connected with Jupiter and the new dynasty of Olympus, is distinguished by the superior gracefulness of its forms; and as being far more intimately accommodated to, and blended with, the common affairs of human society. In it we no longer find gods described only as presiding over kingdoms, nations, and the whole earth; but we are taught to view them as allied to particular families, by the closest ties of affinity and affection. Meanwhile not a single human virtue, and, I fear we must add, not a single human vice, no condition of life, no duty of society whether milltary or civil, no province either of nature or art, is left by this diffusive system unprovided with some appropriate and specific patron, among the numerous hosts with which it peoples the heavens.

> Μεσαι δε θεων πασαι μεν Αγυιαι,
> Πασαι δ' Ανθρωπων αγοραι, μεσή δε θαλασσα
> Και λιμενες.
>
> There's not a path but teems with deities;
> In each assembly and debate of men
> They mix, and fill the seas and every port.

Yet if from the poetical we turn to the moral effect of these systems, we must acknowledge the justice of the condemnation, which Cicero has put into the mouth of his representative of the Epicureans. "Ea quæ poetarum vocibus fusa ipsâ suavitate nocuerunt: qui et irâ inflammatos, et libidine furentes, induxerunt deos: feceruntque ut eorum bella, pugnas,

prœlia, vulnera, videremus: odia, præterea, dissidia, discordias, ortus, interitus, querelas, lamentationes; cum humano genere concubitus, mortalesque ex immortali procreatos." We shall thus be led to feel how gross and how thick was "the covering cast over all people, the veil spread over all nations," and be more sensible of our infinite obligation to the mercy of him, "who has called us out of such a darkness to his marvellous light."

ESSAY INTRODUCTORY

TO THE

ARCHÆOLOGY OF THE WEST OF ENGLAND.

Part II.—HISTORY.

In the preceding part of this introduction was considered the distribution, at the dawn of history, of the Iberian and a branch of the great Celtic nation: the present part will be confined to the changes undergone by the inhabitants of Britain, from the Celtic æra to the Norman conquest, about 1,100 years, comprehending the end of the British, the Roman, and the Anglo-Saxon period, with the invasion of the Danes, and the commencement of the Norman dominion.

At what period, or under what circumstances, Britain and her isles were first peopled, is a problem yet unsolved. The ancient Phœnicians and the inhabitants of Marseilles, are known to have traded in tin with the Cassiterides, supposed with great probability to be Cornwall, but of the manner in which the trade was carried on very little is known; so that although it is certain that Britain was peopled, and by Celts, from a very remote period, many ages perhaps before the arrival of Cæsar, B. C. 55, of its real condition during that time but little knowledge has descended to us, and that little has chiefly been acquired, and can only be increased, by the labours of the painful and judicious antiquary.

It appears that Britain, at the period of Cæsar's invasion, was inhabited by a number of savage tribes, of whom the Romans have preserved the names of above forty, who lived in a state of independence and therefore of barbarism, and who, though from the confined limits of the island they were not nomade, like the inhabitants of the steppes and deserts of the north and east, yet were perpetually at war concerning their boundaries, and were ruled by chiefs.

Although those tribes that passed over with the earliest wave of emigration, and occupied consequently the northern, more remote, and less accessible parts of the island, were the most barbarous, still the tribes of the south were perfectly savage. After the manner of savage nations they painted and tattoed their skins; their offensive weapons were but axes and knives of flint or shell, and stakes hardened in the fire; their acquaintance with metal was circumscribed, and derived chiefly from foreigners; their

hovels were temporary, and their navigation carried on in canoes of osier; their habits were rude and inartificial; their knowledge of the arts trifling; their superstition gross; their vices enormous; their virtues uncertain. Their rudeness has however been instrumental in preserving their memory, for their hiding holes and encampments, their religious and sepulchral monuments of earth and unhewn stones, remain almost unchanged; while the more elaborate structures of later and more civilized nations have fallen into decay and oblivion. The lofty tower and spacious hall, the masterpiece of Norman skill, lie level with the soil, but the green mound which witnessed their erection has survived their downfall, and remains a perpetual testimony of the primæval inhabitants of the land.

It is inconsistent with the limits of this sketch, to enumerate even the principal British kingdoms existing at the arrival of Cæsar: it may however be mentioned that the modern counties of Wilts, Somerset, and Gloucester, formed part of the territories of the Belgæ, Atrebatii, and the Dobuni, uniting along the Bristol Avon; and that Monmouth and South-Wales, the ancient districts of Gwent and Dyfed, were occupied by the warlike tribes of the Silures and the Demetæ.

The invasions of Cæsar were of very limited extent; he penetrated into the country south of the Thames, crossed that river above Kingston, and took Verulamium, the capital of Cassivelan, the chief of the confederate tribes by whom he was principally opposed. After the departure of Cæsar, Britain remained undisturbed by the Romans for nearly a century.

The conquest of Britain having been contemplated by Caligula, and seriously undertaken by his successor Claudius, Aulus Plautius and Vespasian were employed to reduce the nations south of the Thames, a task so difficult to accomplish thoroughly that they called in the aid of Claudius himself, by whom the capital of the Trinobantes, Camalodunum, was taken, and the whole of their territory, now Middlesex and Essex, reduced; Plautius then resumed the command, and Claudius shewed his self-approbation, or the value he set upon his conquest, by the assumption of the cognomen of Brittanicus.

As the power of the Romans in Britain increased, and their affairs there assumed a more favourable prospect of its final subjugation, they erected towns, and established permanent military stations, the names and places of most of which have descended to us.

About a century after the departure of Cæsar, Ostorius Scapula, the successor of Plautius as Roman governor of Britain, had thrown up lines of fortification, northward along the Avon, and westward along the Severn, and shortly afterwards he struck a deadly blow at the liberty, or rather the licentiousness of Britain, by the defeat of its most warlike tribe, the Silures, who were driven from their entrenched camp, traces of which still remain upon the summits of Caer Caradoc, and with their chief, Caractacus, utterly routed before the superior discipline of the legions.

After this defeat the Silures confined themselves more carefully to their mountains, by the aid of which they have still preserved their existence as a people, whilst the other tribes of Britain have long since been swept away.

The Romans, ill-contented with the possession of the southern and eastern sides of the island, pushed on their forces towards the west and north. Suetonius Paulinus, A. D. 60, established garrisons in North Wales among the Ordovices, and planted his victorious eagles in Mona, whence he extirpated Druidism, and drove forth its priests into Ireland and the isles. The consequences of this act, rash and impolitic, and executed with unnecessary severity, were the insurrection of the Britons under Boadicea, and the destruction, with great slaughter, of the rising colonies at Verulam and Malden.

Agricola, whose merits were worthy of the historian with which his fortune provided him, upon his arrival in Britain, found the Romans possessed of the country as far as the Silurian boundary on the west, and that of the Brigantes, or Yorkshire men, on the north, but subject to continual invasion: he introduced a more equitable system of government, permitted Mona again to flourish, and did much towards civilising the nations, by inducing them to adopt Roman manners and habits, and to live peaceably under the Roman sway.

It was during the generalship of Agricola that the first invasion of Caledonia took place, when the natives were signally defeated at the foot of the Grampian chain; but these fierce and hardy mountaineers not unfrequently broke in upon the Roman province, and these invasions at a later period were of importance enough to array against them Hadrian himself, whose rampart, erected A. D. 120, was sixty miles in length, and extended across the country from the mouth of the Tay to the Solway Frith.

The renewed invasions of the Caledonians, notwithstanding the rampart of Hadrian, led Severus, A. D. 208, to construct a second defence, not like the former of turf, but of stone. The line of Hadrian had followed the windings of the level ground, that of Severus, *more Romano,* was carried across hills and valleys, in nearly a straight line; its centre ran only a few yards north of the ancient rampart.

The Romans divided Britain into five provinces, Britannia prima and secunda, Flavia Cæsariensis and Maxima, and Valentia, and a sixth was subsequently added on the north by Vespasian, Vespasiana. The capitals of these provinces, most of which still present traces of Roman work, were Richborough, Caerleon, London, York, Whittern, and Inverness, and besides these were stations scattered thickly over the country, and connected by regular roads, most of which are still apparent. It would be tedious now to enter more minutely into the enumeration of these stations and ways, they may be seen in the map of ancient Britain, published by the Society for the Diffusion of Useful Knowledge, which is on the whole tolerably correct, and may be purchased for a few pence.

The Romans achieved less towards the civilisation of Britain than of any of their other conquests, owing probably to the disturbed state of the country, and its distance from the seat of empire; circumstances which led necessarily to the delegation of great irresponsible power to the generals, and to their abuse of it. Britain became proverbial as "fertile in usurpers," and was oppressed by a series of petty tyrants, who took advantage of any irregularity in the government at home, to act as independent sovereigns abroad.

The occupation of the country by the Romans must however, though unsettled, have been tolerably complete, since as we shall hereafter shew, they very materially affected the vocabulary of the British language.

But the time approached when the conquerors of the world were themselves to be conquered; and the shock that finally destroyed the great centre of empire, was felt first at the circumference. Various nations hitherto unheard of or repressed, began to occupy a place in history. Before the third century the Roman policy had become infirm and vacillatory, and during the joint reign of Valerian and his son Galienus, the Germanic nations crossed the Rhine in great numbers as Franks or free men; by degrees they traversed Gaul, crossed the Pyrhenean boundary, overran Tarragonia, and extended their ravages to Catalonia and the south-west of Spain, pointing out an easy way to the Burgundian and other Teutonic tribes, who were not slow to avail themselves of the example.

But Britain was threatened from a different quarter. The root of the Cimbric Chersonese, now Holstein, was inhabited by the Saxons, a tribe of barbarians mentioned by Ptolemy as existing there in the second century, and who at a subsequent period gave name to the country between the Rhine and the Oder.

Their neighbours on the north were the Angles and the Jutes, like themselves fierce and warlike, and from their maritime situation much given to piracy.

At this period also the Picts and Scots made their appearance, so that when, about the middle of the fourth century, the Roman forces were formally withdrawn from Britain, the natives were attacked on all quarters—on the north by the Picts and Scots, on the south and south-east by the Saxons.

Britain, at this period, was ruled or rather misruled by a number of turbulent persons, partly of British and partly of Roman origin, by whom the force of the country was reduced to so miserable a condition, that in order to defend themselves from the Picts, they were glad to call in the Saxons, who under the guidance of Hengist and Horsa landed in Kent, A. D. 449.

The Scottish marauders confined their ravages to the northern provinces, and possessed themselves of the kingdom of Deira, or Northumberland. The Saxons having once obtained a firm footing in the country, never left it, and by the help of their allies, the Angles and the Jutes, they drove

forth the Britons into the western and north-western provinces, eradicated what remains of their language or customs the Romans had left in the plain country, and finally possessed themselves of all the central and southern parts of England, which they erected into the seven kingdoms of the heptarchy.

Thus except by the Britons of Wales and Cornwall, and the unconquered nations of the north, was the Anglo-Saxon government obeyed in Britain; harsh and tyrannical at first, it became milder as the dangers of revolt diminished, and ruled over a population chiefly of Anglo-Saxon descent.

But continued peace and prosperity, by rendering the Anglo-Saxons more civilised and less warlike, exposed them in their turn to invasion.

A barbarian tribe, inhabiting the peninsula of Jutland, the shores of Scandinavia, and the islands of the Baltic, pirates from their situation, like the Saxons of yore, and styled "Sea Kings," began to extend the sphere of their depredations, and under the appellation of Danes or north men, ravaged the shores of Gaul and Britain.

Their descents upon Britain were numerous and successful; the east, north, and western coasts lay open to their attacks, and they succeeded at last in overthrowing the power of the Saxons, and reducing their authority to a condition from which even the glorious reign of Alfred afforded only a temporary respite. Traces of these struggles are readily to be detected in the western parts of the island, and especially near Chippenham and along the shores of the Bristol Channel. We shall have occasion subsequently to refer to them in detail.

Shortly after the death of Alfred, the Anglo-Saxon monarchy fell to the ground, and the celebrated Danish chieftain, Canute, took his seat upon the vacant throne of England. By his posterity it was occupied until the failure of the male line, when the Saxon dynasty was restored in the person of Edward the Confessor, in 1042. A few years, however, during the reign of his successor, Harold, brought that dynasty a second time to its close, and established, A. D. 1066, a new and hardier race of conquerors permanently on the throne.

The above sketch, almost necessarily imperfect, could not conveniently have been omitted, since when treating of the language and topographical remains of the successive inhabitants of Britain, it will be necessary frequently to refer to the order and time of their several invasions and occupations of the island.

In the next part of this essay we shall take up the languages, of which traces are to be found in Britain.

(To be Continued.)

CAERPHILLY CASTLE.

Essay on Caerphilly Castle.

No. III.—CAERPHILLY AS IT FORMERLY STOOD.*

(Continued from page 104.*)*

We now approach the third and most important division of our subject, the description of the castle as it formerly stood; and in drawing up this description care has been taken to distinguish between fact and hypothesis, between those restorations which are warranted by a critical examination of the remaining portions, and those which in the absence of a sufficient remainder, have been deduced from analogous and more perfect structures.

For the purposes of description we shall consider the castle as composed of ten parts, each of which will be further subdivided, so that the whole may pass before us in regular review and in a convenient order.

These parts are: A The GATEHOUSE; composed of α the *moat;* β the *draw-bridge;* γ the *gate-house proper;* δ the *gate-house tower;* ε the *dividing-wall.* B The NORTHERN CURTAIN; a the *grand postern;* b the *covered way;* c the *buttress towers;* d the *north postern;* e the *postern gallery.* C The SOUTHERN CURTAIN; *a* the *semicircular bastion; b* the *mural chamber; c* the *buttresses; d* the *sluices.* D The TERRE PLEIN; 1 the *mill.* E The TETE DU PONT; composed of I the *mural tower;* II the *south postern;* III the *flanking wall.* F The LUNATED RIDGE; containing × the *inner sluice.* G The HORN WORK; including 1 the *spring;* 2 the *outer;* and 3 the *inner western draw-bridge.* H The MIDDLE BALLIUM; including 1 the *principal bastions;* 2 their *curtains;* 3 the *middle eastern;* and 4 the *middle western gate-houses;* 5 the *water-gate and steps;* 6 the *offices;* 7 the *tank.* I The INNER BALLIUM; containing α the *principal bastion towers;* β their *curtains;* γ the *inner eastern;* and δ the *inner western gate-house;* ε the *triforial galleries* and *ramparts;* ζ the *court;* η the *well;* θ the *hall;* ι the *chapel* and smaller rooms; κ the *state apartments.* K The REDOUBT.

The eastern or grand façade of Caerphilly is one of the finest and most complete specimens of a feudal line of defence, extant in this or any other country.

It is composed of a long curtain wall of appropriate height and thickness, strengthened on the exterior by proper buttresses, rising in the centre

* Many of our readers will feel disposed to consider the following description as tedious: should they, however, ever include Caerphilly within their summer excursions, and visit the castle with this description in their hands, we do not apprehend that they will find it either too dry, or running unnecessarily into details.

Hitherto but little attention has been paid to ancient military architecture, the descriptions extant of castles and such buildings being deficient in critical information. It is hoped that many of the terms above introduced will be found useful in future descriptions.

into a broad and lofty gate-house, and terminated at either extremity by clusters of towers that materially diminish the danger of being outflanked. The whole is preceded by a broad and deep moat, supplied by a river, and crossed by a drawbridge. The length of this façade is about three hundred and sixty-two feet, its height is extremely variable.

It will be convenient to consider this front under three principal divisions, which we shall designate as the GATE-HOUSE, and the lines of the NORTHERN and SOUTHERN CURTAINS.

GATE-HOUSE. The GATE-HOUSE is not exactly in the centre, but is nearer to the northern flank; its line of front does not coincide with those of the curtains, the plan being somewhat irregular.

Moat and Draw-bridge. The *moat*, about sixty feet wide, and of variable depth, is crossed by a double *draw-bridge*, that is to say, there is a great pier in the middle, from one end of which a bridge could be dropped upon the semipier on the field side, while from the other end a similar bridge fell towards the fortress. By this contrivance the central pier could be readily converted into a sort of isolated barbican, and being about twenty feet high, and twenty feet broad by thirty long, with a bold salient on either side, would form a very respectable outwork.

The distance from the central to the outer pier is nineteen feet, from the central pier to the portal eighteen.

Gate-house proper. The *gate-house* is a lofty oblong building, fifty feet in breadth by thirty-five in depth, and about sixty high; it is perforated below by the vault of the portal, but rises above into one broad tower. The lateral portions of the gate-house project six feet beyond the portal, and form the northern and southern lodges.

The portal, nine feet eight in width by twenty in height, was defended by gates, a portcullis, and a stockade; two loops on either sides command it, and just within these a door leads into either lodge: the lodges measure twenty feet by ten, are floored with timber, and furnished with fire places. Each of them, besides the two loops looking inwards, has one in front towards the bridge, and that on the north has two, that on the south one, looking in a contrary direction along their respective curtains. The outer walls of these chambers are nine feet thick.

Gate-house Tower. Passing onwards through the gate-house we arrive upon a plot of sward behind it, which will be mentioned as the terre plein. On our right hand are two doors in the wall of a tower, into which the northern part of the gate-house is prolonged westward.

From the first door, a hexagonal well stair, nine feet in mean diameter, ascends to a number of apartments upon two stories, and terminates in a quadrangular turret. In the lower story are chambers for working the portcullis and other defences of the principal and a subordinate portal, and a small fire place and oven, apparently for heating pitch, lead, &c. for the

benefit of besiegers. These rooms are vaulted. From the first story also a passage leads upon the rampart of the northern curtain, and crosses, upon a temporary plank, an abyss in the thickness of the wall, about twenty-nine feet deep and five wide, and opening below between the grates of the grand postern.

There are in the gate-house and tower connected with it seven chambers.

Dividing Wall. From the gate-house a wall runs westward for eighty feet, being twenty feet high and six thick, embattled towards the north, and apparently accessible only by temporary scaffolding; it terminates abruptly on the margin of the inner moat, and thus divides the great façade into two parts, so that even were the northern or weaker half taken, the southern half would remain almost as impregnable as before.

The communication between these two parts was carried on *above* by the door leading from the gate-house tower upon the rampart, and defended as we have seen by an abyss, and *below* by an arched portal fifteen feet in length, and regularly defended by gates, a portcullis, and a draw-bridge of unusual length.

NORTHERN CURTAIN. If, instead of entering the castle by the draw-bridge, we had crossed the moat just north of it, we should have passed under the northern wall of the gate-house, and arrived at a low-browed postern in the curtain, opening at the water's edge.

Grand Postern. Passing it, first through an iron grate, then under the abyss before mentioned, and finally through a second grate, a gallery leads up a gentle ascent towards the edge of the inner moat.

Covered Way. This gallery lies north of the dividing wall, between it and a low wall of inconsiderable thickness, and is in fact a covered way. It is crossed near the postern by the draw-bridge connecting the north and south lines of front.

The northern curtain, in which the grand postern opens, runs northward for three hundred and sixty feet, and is strengthened exteriorly

Buttress Towers. by three buttress towers, quadrangular and solid below, but hexagonal and chambered above; each has a projection of twenty, with a breadth of twenty-four feet. The chambers have a loop in front, and one at the junction of the tower to the wall on either side: they were accessible only from the rampart, and probably by means of a trap door in the timber roof. A similar buttress tower may be seen at Portchester, next, on the north side, to the Norman keep.

North Postern. In the curtain itself are six loops, opening in pairs between the buttress towers. The curtain terminates northward in a pair of towers, similar in all respects to the other buttress towers, but connected together by the vault of a portal, regularly defended with gates, portcullis, and draw-bridge, and leading out as

the *north postern*, upon a plot of ground and causeway, separating the two outer moats. This postern seems to have been contrived for the exit of cavalry.

Postern Gallery.

Behind and parallel to the curtain, at a distance of nineteen feet, was a slighter wall, four feet thick, and rising to nearly the height of the curtain, with which it was connected by a timber roof. By this means a broad walk was formed for the defence of the rampart above, and a convenient and safe gallery below. To this walk access was obtained from the gate-house, over the abyss before-mentioned, and into the gallery, by the draw-bridge described as crossing the covered way of the grand postern.

SOUTHERN CURTAIN.

Semi-circular Bastion.

Mural Chamber.

Buttresses.

Sluices.

The general disposition of this curtain is irregular; it passes off south-east from the gate-house, then makes a bold sweep eastwards, and then westwards, forming a large semi-circle. From thence the wall passes off straight westwards, and then changing its direction at a right angle, finally crosses the bed of the river in a southerly direction, and terminates in a tête du pont. This wall contains a chamber and sewers at its internal angle, is supported exteriorly by seven quadrangular, solid buttresses, and is perforated at one end obliquely for the discharge of the mill stream, and at the other for the passage of the nant-y-gledyr, being at that part, where it is subject to great pressure, fifteen feet thick. The rampart is accessible from the tête du pont, and at the internal angle, here as below, is a mural chamber, serving as a *place d'armes*: the face of the wall, between the buttresses, is wrought into a concave arc, the chord and sine of which increase towards the summit, so that any heavy missive dropped from the rampart, would be projected outwards by the conical slope of the wall. The soil rises twenty-four feet higher on the inside than on the outside of this curtain.

TERRE PLEIN.

Mill.

The terre plein is a large surface of sward behind the southern curtain, and bounded posteriorly by the counterscarp of the inner moat. Upon it stood the mill, and from its inner boundary dropped the inner draw-bridge. It varies in breadth from its commencement at the gorge, to the dividing wall, where it measures ninety-four feet.

TETE DU PONT.

Mural Tower.

South Postern.

Flanking Wall.

The tête du pont terminates the southern, as the double towers the northern curtain; it consists of a curve of the wall westward into a semi-circle upon which rises a mural tower, and a gate tower, with a regular postern, beyond which the wall bifurcates, one limb defending a sort of causeway towards the south-west, and another running towards the river, north-west; these seem designed further to prevent the curtain from being out-flanked.

Such is the principal line of defence, and upon ground nearly level

it would have been difficult to have devised one better suited to withstand the means of attack which that age was likely to have employed against it.

LUNATED RIDGE. The counterscarp of the inner moat, formed on the east by the terre plein, is continued along the northern face of the castle by the lunated ridge, until it terminates on the west in the horn-work.

There is a tunnel and sluice in the ridge, by which the communication between the moats could be regulated.

HORN-WORK. The horn-work, covering the western front of the castle, is an irregular polygon, rising on every side with a revêtement or lining wall, fifteen feet high, and falling off above with a talus of about eight more. From its south-western face gushes *Spring.* a perpetual fountain, the principal supply of water to the castle. Towards the north-west is a low tower or pier, whence fell the draw-bridge by which it was connected with the main land. The general breadth of the moat is here about sixty feet, but the *Outer and inner Western Bridge.* space between the abutment of the bridge and the opposite bank, is only twenty. The horn-work is connected with the body of the place by a similar draw-bridge, the span of which is twenty feet.

MIDDLE BALLIUM. We now arrive at the description of the middle and inner ballia, the buildings occupying the island which has already been described as terminating the peninsula.

This island is cut and scarped into a parallelogram, two hundred and seventy feet east and west by two hundred north and south. The four angles are capped by bastions of three-fourths of a circle, the intervening straight lines being styled, in the language of fortification, curtains.

If we imagine the sides or scarps of those curtains and bastions to be faced with a perpendicular stone wall, thirty feet high, and surmounted by a parapet of from five to twelve more, we shall form an adequate idea of the basis upon which the two remaining ballia of the castle are placed.

If we suppose a second parallelogram, smaller than the last, to be placed within it, we shall have the last of these concentric defences before us as the inner ballium; the space between this and the boundary of the larger parallelogram being the middle ballium.

The middle ballium presents thus four divisions, facing towards the four cardinal points, all forming terraces of nearly equal breadth, and the opposite sides being of equal length. Upon the east and west are the gate-houses, on the south offices and a water gate, and on the north an open terrace overlooking all the outer defences of the castle on that side.

We shall commence our description of the middle ballium from the eastern side.

Here the width of the moat is only forty-five feet, a space too wide in-

deed for the span of a single draw-bridge, but rather too narrow, and too near the citadel, safely to admit of the erection of a permanent central pier. The expedient of a temporary one of timber was probably here, as at Raby and Holt castles, adopted, upon which, placed in the centre of the moat, a bridge from either side might be securely dropped, but which admitted of instant destruction in the event of a siege.

Eastern Gate-house. The eastern entrance from this bridge, passed beneath a vaulted portal, with the usual defences, and placed between two semi-circular towers, with a very considerable projection, and connected by the continued portal, with the gate-house of the central ballium.

These towers are very thick, but of no great height, and contain a lodge on either side, lighted by three narrow loops, and above these lodges was the battlement.

Attached to the northern of these towers is a square building, the use of which baffles even antiquarian conjecture.

Between this gate-house and the inner one, a door seems to have led off on either side, to the offices and terrace.

Western Gate-house. The gate-house at the opposite or western extremity of this ballium differs materially from the last. The portal is loftier, and the front more extended. There are two chambers on either side of the portal, a first story, and fire-places with handsome chimneys.

Water Gate. Nearly in the middle of the southern side of this ballium it is intersected by a vaulted passage, leading downwards by steps from the inner ballium to the moat, upon which it opens by a water-gate. This passage leads from the hall, and at its lower end is a place for boats, &c. It is vaulted by a succession of short horizontal arches, instead of by one long sloping vault. A similar contrivance is adopted at the neighbouring fortress of Castelh Coch.

Above this passage are chambers apparently intended for servants' lodgings, and the space between it and the eastern gate-house, com-

Offices. prehending a fourth of the ballium, is occupied by the offices. These consist of a low tower of one story, of prodigious thickness, and vaulted to form the kitchen. Here are fire-places and a pair of curious recevoirs apparently for hot water, communicating by flues with the atmosphere. The first story seems also to have been provided with large fire-places, as at Morlais and Castelh Coch. Adjoining the kitchen is a building with a flat roof a sort of servants' hall, an oven,

Tank. and an open tank, fifty feet long by twenty wide.

Inner Ballium. We now arrive at the inner ballium, an oblong space two hundred feet east and west by one hundred and sixty north and south, contained within four curtain walls, the eastern and western of which are broken by lofty and magnificent gate-houses, and the

four angles capped by as many circular towers. Of the enclosure, or court thus formed, the southern side is occupied by the hall and other apartments.

Bastion Towers.

The four towers which cap the angles of this ballium are very marked features in the general appearance of the castle; they have a projection without of three-fourths of a circle, are high, and eighteen feet in their interior, and thirty-six feet in exterior diameter, at the bottom; they are divided into three stages, by wooden floors, and the walls are nine feet thick. Each story is lighted by loop-holes, very large within, and diminishing externally to a line; a circular well-stair winds to the summit of each tower. These towers open into the court and upon the battlements.

Curtains.

Of the curtain walls those on the north and east are not above thirty feet high, battlement inclusive. Those on the south and west are higher by a story, and the rampart walk is continued round them, below as a vaulted triforial gallery, and above as an open walk.

Eastern Gate-houses.

The gate-houses of this ballium are surpassed by no others in this country. That on the east is an oblong building, with two semi-circular bows without, towards the east, two circular stair-case towers within the court, towards the west. The arch of entrance is broad but low, and defended by gates, portcullis, and stockade; besides a contrivance within for dropping hot liquids upon any assailants who might have gained the court from the other side. On each side of the portal are lodges, and the first story is a spacious hall or council-chamber, with an enormous fire-place, and two large and handsome windows looking towards the court. Above this chamber is the battlement. On the north and south sides of this gate-house are a number of small apartments, mostly vaulted, and used for various purposes, as portcullis rooms for the portals to the ramparts, &c. One of them, on the south, is fitted up as a small oratory, it has a ribbed roof and two decorated windows. There is a similar apartment, but of earlier date, in the castle of Chepstow.

Western.

The western gate-house in shape and dimension resembles the eastern, except that it has no projection or staircase-towers within the court, its staircases running up in the thickness of the wall. The lodges below, on each side of the portal, are vaulted and ribbed, and seem to have been used as prisons: they do not open into the portal, but into the court. The state chamber above is not so large as that in the eastern gate-house, but its floor is vaulted instead of being of timber.

Triforial Galleries.

The triforial galleries have loops towards the field; they are about eight feet high and four wide, vaulted, and lying in the thickness of the curtain wall. Of the ramparts and battlements we shall speak afterwards.

Well.

In the court, apparently in a most inconvenient and dangerous place, is the well, about four feet in diameter.

Hall. The hall is an oblong chamber, seventy-three feet east and west by thirty-five north and south, and about thirty feet high. It is lighted by four lofty and large windows towards the court, which with a huge fire-place between, and a door to the east of them, occupy the north side. In the south side is a door leading down the steps to the water-gate, and a second leading to the kitchen, offices, and tank. A door at the west end opens into the state apartments, and two other doors and a large window on the east communicate with another apartment and with the chapel.

The roof, of wood, springs from short pilasters resting on corbels, placed against the north and south walls. The north wall is of dressed stone, and divided horizontally by a string about three feet from the ground, and a second, which runs along the east side also, on a level with the returns of the drip-stone of the door; the east, south, and western sides were plastered, and probably covered with tapestry.

Chapel. The chapel, evident from its position and large east window, presents nothing remarkable; neither do the state apartments, with the exception of one long window hereafter to be noticed. These apartments are four in number; two on the ground, and two on the upper story; they are lighted by windows towards the north, and are connected by doors on the eastern and western sides. A staircase, in the thickness of the curtain wall, leads to the triforial gallery, as well as to the upper apartments, and to some smaller out-buildings, which seem to have been added at a later period.

Redoubt. In our description of the disposition of the ground upon which the castle stands, mention was made of a knoll, lying to the north-west of the castle, and crowned with a redoubt.

The body of this earth-work or redoubt is quadrangular, being capped at the angles by four bastions, and excavated in the centre into a sort of open casemate. The curtain towards the castle is intersected by two trenches, separated by a mound of earth or cavalier, and leading into the casemate.

Round the redoubt, and following the curve of its bastions, is a fosse, upon the three outer sides broad and deep, and but slightly marked on the fourth. The ramparts of the redoubt are unprovided with either parapets for cannon, or banquettes for musquetry, and the scarp is continued unbroken to the rampart; neither that nor the counterscarp, though steep, being supported by a wall.

Without the fosse, in advance, is a spacious glacis, terminating in four low bastions and a shallow fosse. Both the fosses of this work were probably dry.

The whole work resembles much those thrown up during the parliamentary wars, though it seems either never to have been completely finished, or else, which is less probable, to have been partially destroyed.

The above description, which, tedious as it is, ought to have been twice as full, has taken up so much space that we must defer to the next part of this essay the consideration of the details and architectural ornaments of the building, such as the construction of the loops and draw-bridges, the ornaments of the hall, &c. which, with our general conclusions respecting the date of the building, and an account of its present condition, will bring this essay to a close.

(To be continued.)

LETTER FROM EXETER CHANGE.*

Mr. Editor,

Nobody can read your inestimable work, without being assured that you would permit its extensive circulation to record the memory of departed greatness. Both the life and death of those who have towered above the level of their fellow-mortals, and been distinguished by peculiar gifts whether of body or mind, must always be worthy of a place in your valuable miscellany. Few of your numerous readers are ignorant of the loss which the metropolis has sustained, in the much lamented departure of Mons. E. Le Fant; indeed it may be truly asserted, that the death of this well known gentleman has occasioned a chasm in the circle of his friends, which none who remain can ever hope to fill up. For the instruction then of your readers, allow me to enter rather minutely into the circumstances of his history.

Mons. E. Le Fant, notwithstanding the Gallic sound of his name, received his birth in India; his family is one of the most ancient in that vast country; now to ascertain its origin is impossible, but it may be truly asserted, that its noble root has sent forth a trunk and branches which rival the remotest genealogies of the West. Many of the ancestors of this remarkable personage have been distinguished warriors; if they have not actually commanded armies, they have held the most conspicuous posts in contests which have decided the fate of empires. If history is to be credited, the progenitors of Mons. E. Le Fant have marched from the banks of the Ganges to those of the Tiber, and have struck terror into the hearts of the Romans themselves. The worthy subject of this memoir possessed all the great and military qualities of his family, although the peculiar circumstances of his life did not call them into exertion. The qualities most remarkable in Mons. E. Le Fant were sagacity, confessedly superior to his fellows, that mildness of behaviour which ever attends true greatness, a gentleness and courtesy of manners which encouraged all to

* The following letter will perhaps amuse some of our readers; it commemorates the death of the celebrated Chuny, who it will be remembered was obliged to be shot in Exeter Change some time since.—Ed.

approach him with confidence, and to lay aside that extreme awe which the previous knowledge of his gigantic powers naturally created in common minds. The deceased did not trouble himself much concerning politics; but I believe he was not less loyal than others of his family, who had often supported royalty in troublesome times, and I believe no man was more willing than himself, to take his share in bearing the heaviest burthens of the state. He was not particularly attached to Whig or Tory; although some of his relations had suffered from the schemes of Mr. Pitt, yet he felt no ill-will to the memory of that minister. With Mr. Fox he was intimately acquainted. Lord Brougham has occasionally been seen in his house; and between himself and Lord Den-man there had existed a sympathy of feeling from their earliest years. In his transactions of public business upon 'Change, he was equal to the wisest of those around him; many who plumed themselves as his superiors in mercantile affairs, were, in point of fact, far beneath him. No one could be long in his company without perceiving that it was in his power to overreach his competitors; but he constantly disdained to exert that power, but in the most open manner. In fact there was a straightforwardness in his habits, and mode of doing business, which I have often paused to admire. It was very difficult to move him when he thought he had taken a right step; this was the more remarkable, as many of his surrounding friends were very changeable, continually aping the idle follies of the day, and shewing a versatility and restlessness, that afforded a curious contrast to the established habits of Mons. E. Le Fant. Not, Sir, that I mean to assert that this almost spotless character was deaf to the voice of reason; no, though he would not attend to the suggestions of those who were in their understandings little above the brute creation, yet it was a bright part of his worth, that at the call of duty or reason he would instantly give up any wrong position he might have taken. He did this, not indeed with that weathercock quickness which promises no continuance; but when Mons. E. Le Fant turned round, it was with a solemnity and majesty which decidedly marked the consideration he was giving the subject, and how much he valued solemnity of carriage. The dress of Mons. E. Le Fant was extremely plain and simple; from his always wearing clothes of the same sombre colour and pattern, some supposed him to be of the Quaker persuasion; but this was an error, as he was essentially at variance on many points with that respectable sect: from the general solidity of his views, he was probably of the establishment. I am certain he was not a Papist; no one was ever more averse than he was to persecution of any kind; indeed he was perhaps too liberal, for though he had passed many years of his life amongst those, who, to say the least, were never seen in a place of worship, yet he was never heard to utter a word against them. His food and habits were very temperate, nay, abstemious; he very rarely touched meat; water, bread, fruit, vegetables, constituted his chief aliment; and if he indulged himself

in any thing to excess, it was in cakes and buns, of which he was remarkably fond. He was an early riser, and the ringing of his bell announced to his household that he expected them to follow his example. As his wants were few, so he was very generous of his money; it might literally be said, that whilst he had sixpence in his box, he was willing to take it out and give it to those whom he probably would never see again, and from whom he could expect no return. That such a character should be sought after, can excite no surprise; it was even necessary to have public days appointed to receive his friends, who flocked from all parts of the kingdom. Some even brought their little children, as if it would be a pleasure to them in after life, to say that they had seen him.

Allow me, Mr. Editor, to close this memoir with an account of his much lamented decease. He died, as an eminent surgeon pronounced, from a most violent attack of the Morbus Plumbeius, or bullet fever, a disease which carried off the immortal Nelson, and, also, a distant connexion of his own, the renowned General Wolfe. It is consoling to know that all his old friends were round him when he breathed his last; and, although they were debarred (probably through fear of catching the disease) from actually pressing his friendly hand, or closing his dying eyes, yet the unconstrained nature of their feelings can be more easily imagined than expressed. Great honours were paid to his remains. It was observed that our excellent King, with an attention duly appreciated by his subjects, had permitted some of his own guards to attend on the melancholy occasion; and many medical gentlemen of the first practice, who had been called in, begged to be present at the last ceremonies. Several articles of property belonging to Mons. E. Le Fant, and even portions of his wearing apparel, were anxiously sought for; these were distributed among his admirers, and each was permitted to take that which best suited his taste; all seeming desirous to have something which would remind them of the deceased, and professing they would carefully preserve the inestimable relics.

REVIEW.

The Temple; Sacred Poems and Private Ejaculations, by George Herbert. 8*vo. vol. II. pp.* 340. *London, Pickering,* 1835.

This volume contains the English poems of Herbert; the Synagogue, a collection of pieces in imitation of the Temple, by the Rev. Christopher Harvie, A. M. a contemporary; Herbert's Latin poems; an English poem ascribed to Herbert, and hitherto unpublished; and a few short notes by Mr. Coleridge. The volume before us is the second; the first, which has not yet appeared, will contain the life by Walton, and Mr. Herbert's prose

works. We shall take advantage of the present opportunity to give some account of the writings of this learned and excellent man, and preface our observations with a short sketch of his life and character.

The life of Herbert has already been written by Isaac Walton, one of the simplest and best of our earlier English biographers, and remarkable for that attention to minute details which constitutes the very charm of original biography, as well as for the careful selection of the subjects for his pen; whose characters were in every case such as permitted them to be brought prominently before the public eye, without injury to their previous reputation.

The life of Herbert, though from the peculiar excellence of his character it will ever be among the most interesting, is not to be ranked among the best of Walton's productions, probably from the circumstance of no personal acquaintance having subsisted between the two, although indeed they were contemporaries, and had many friends in common.

George Herbert was born on the 3rd day of April, 1593, in the castle of Montgomery, the patrimonial inheritance of his family. His father, Richard Herbert, was the representative of a younger branch of the house of Pembroke, at that time in the zenith of its reputation, and whom he is said to have resembled in personal appearance, as well as in the honour and integrity of his character. He died prematurely. His mother, Magdalen, the daughter of Sir Richard Newport, of High Ercal, Salop, the birth-place of Richard Baxter, was celebrated for the beauty of her person, and for eminent piety and strength of character, charms of a far more enduring description, and which gained for her the admiration of Dr. Donne, and enabled her to educate with success the numerous family, whom the death of her husband placed under her charge.

Their children, ten in number, three daughters and seven sons, of whom George was the fifth, were honourably distinguished in after life, although the names of the eldest only, Edward, the celebrated Lord Herbert of Cherbury, and George, are at present generally known.

George was brought up under the care of his mother and her domestic chaplain, from the age of four, when he lost his father, to twelve, when he entered Westminster school, where he remained, until, at the age of fifteen, being king's scholar, he was elected to Trinity College, Cambridge, in company with Mr., afterwards Bishop Hacket; the master, Mr. Ireland, saying: "That he expected to have credit by them two at the university, or would never hope for it afterwards while he lived."

During his residence at Cambridge his mother remarried to Sir John Danvers, after having been twelve years a widow; during which time she had entirely devoted herself to the education of her children, residing four years at Oxford with her eldest son.

Lord Herbert, in his character of his brother, informs us that he was "Not exempt from passion and choler, the infirmities of his race, although

otherwise without reproach." And we learn from his attendance at court, and from his lines,

> "Whereas my birth and spirit rather took
> The way that takes the town;"

as well as from other passages in his life, that he was fond of gaiety and dress, and apt to value himself upon his birth; nevertheless, the habit of his mind seems ever to have been of a serious cast, and in his second year at the university we find him, in a letter to his mother, dedicating "his poor abilities in poetry to God's glory," and rejecting all the subjects and figures drawn from pagan mythology, so fruitful a source of the figurative language of the day, and one of which his learning qualified him to make ample use.

That he was an industrious student in the learning of the university, his progress places beyond doubt. He was made bachelor of arts in 1611, master, and major fellow of his college in 1615; and in 1619 he was selected to fill the honourable office of university orator.

In this capacity he became known to James I., whom it fell to his office to thank for his gift of the "Basilicon Doron" to the university, which he did in a letter, with the Latin and the conceits of which the royal pedant was so highly delighted, that he pronounced the writer to be the "jewel of the university."

Herbert also gained credit by some verses against the celebrated Andrew Melville, in defence of the church of England, and Lord Bacon dedicated to him his translation of a portion of the Psalms of David into English verse.

At this period he seems but seldom to have visited Cambridge, retaining his oratorship only in compliance with his mother's wishes, and chiefly to have followed the court, where he is said to have been enabled, by the gift of a sinecure office, to indulge in his love for fine clothes and court-like company.

At this conjuncture, however, it pleased God, by the death of his royal patron, James, and that of two of his most powerful friends, to detach him at once from the dangers and uncertainties of a court life, as he quaintly called it, "a nothing between two dishes," and to strengthen in him those higher views, of which he had ever given more or less promise. Having considered the subject during a year, he determined upon entering the church.

This resolution he announced to a friend, who would have dissuaded him from it, on the ground of its being beneath his birth and expectations, in the following very remarkable words:

"It hath been formerly adjudged, that the domestic servants of the King of heaven should be of the noblest families on earth: and though the iniquity of the late times have made clergymen meanly valued, and the sacred name of priest contemptible; yet I will labour to make it honourable, by consecrating all my learning and all my poor abilities to advance the glory of that God that gave them; knowing that I can

never do too much for him that hath done so much for me, as to make me a Christian. And I will labour to be like my Saviour, by making humility lovely in the eyes of all men, and by following the merciful and meek example of my dear Jesus."

Upon taking deacon's orders, he was made prebendary in the cathedral of Lincoln, of Layton, where, with the assistance of his mother and some private friends, he rebuilt the church.

In 1627 his mother died, and shortly afterwards he married Jane, the daughter of Charles Danvers, of Bainton, Wilts, and was presented by his kinsman, the Earl of Pembroke, to the living of Bemerton. We are told that he then exchanged the sword and silk gown, which as a deacon he had been permitted to wear, for a canonical coat.

His wife proved in every way a companion suited to himself, and they dwelt together in the continual exercise of piety, until his death at Bemerton, in 1632, at the early age of thirty-nine.

Dr. Henchman, bishop of London, who ordained him priest, never mentioned him but with veneration for his excellent life and learning. "I laid my hands," said he, "on Mr. Herbert's head, and alas! within less than three years, lent my shoulder to carry my dear friend to his grave."

The excellence of Herbert, as Coleridge has observed of his poems, will never be felt without a sympathy with the mind and character of the man.

His piety, though perhaps chiefly evident in his humility, was of an active kind, and a very practical tendency. His love for the Church of England, like that of his friend Hooker and of many others of their day, who did not think that "the further they went from the Church of Rome the nearer they were to God," was ardent and durable; it led him not into polemics, nor into the clamorous controversy of that and the succeeding age, but it was apparent in his actions, and is intermingled with the love of God in all his writings, as though it were the bodily figure which the spirit of his devotion best loved to animate. His religion taught him his duty, not to God only, but to man: it influenced him, both in the greater events of his life, and in his every-day intercourse, and taught him the highest style of politeness, that which proceeds from the heart instead of the head.

Herbert was but little given to spy out faults in any character but his own; but was wont to insist upon the necessity of a close attention on the part of the clergy to their parochial duties, as the best antidote to the evil that might be abroad.

The associates of Herbert were among the best characters of the age, Bacon, Hooker, Wotton, Donne, were among the chief: he knew what was due to his own birth and station, and he ensured the respect of others, by shewing that he respected himself.

His ideas of friendship were just and noble; and Mr. Nicholas Farrer was his chosen friend; a man who was severely ascetic without a tincture of moroseness, and who dedicated himself wholly to God, without neglect-

ing what was due to his neighbour also. The friendship of these men was one of no vulgar stamp; it was a friendship, based on religion, cemented by mutual views and sympathy; a friendship, commenced in youth, and matured in manhood, growing with their growth, and strengthening with their strength, continuing unbroken through life, and only discontinued in the moment of death, to be perfected in the eternity of a resurrection.

Like Bishop Horne after him, Mr. Herbert was a great admirer of music, in which he is also said to have been himself a proficient: it formed the solace of his leisure hours, and this accomplishment betrayed him not into idle habits, but stirred up his devotional feelings, and instead of calling forth the concealed evil of the heart, became in his hands a vehicle for such sentiments as purify and exalt the mind.

He matched "music against music;" he said that "It did relieve his drooping spirits, repose his distracted thoughts, and raised his weary soul so far above earth, that it gave him an earnest of the joys of heaven, before he possessed them."

It is recorded that in Mr. Herbert's first sermon at Bemerton, he gave his parishioners many necessary, holy, and safe rules for the discharge of a good conscience towards God and man, and this with great learning and eloquence; but at the close he told them that this should not be his constant way, religion not consisting in hard questions, but that he should in future be plain and practical.

He ever selected the subject of his sermon from the services of the day, and he was at great pains to explain the reasonableness and fitness of those services.

On Sunday afternoon he catechised, a practice now without any authority laid aside, and he was careful never to exceed half an hour in length.

In compliance with a regulation of the church, still in force, he had prayers twice daily in the chapel annexed to his house, and they were attended by the labourers and many of the gentry; such was the influence of his example.

The death of Mr. Herbert was perfectly in accord with his life. His temper, which, under constant watchfulness, seems to have lost all traces of asperity, was unruffled by his bodily suffering, and his frame of mind remained unchanged to the last. He died, as he had lived, a Christian; and his last words bore testimony to the stability of that belief, by which through life he had been actuated. He reflected honour upon a family at that time of the brightest among the English nobility, and added another to the long list of excellent and able men, who have owed their education to superior mothers.

A little before his death he sent the manuscript of his "Temple" to his dear friend Mr. Farrer, with a request that he would read it, and publish or burn it as he might think it likely to be useful or not; for added he, "I and it are less than the least of God's mercies."

That men equally, or it may be more excellent, than Herbert, do not still exist, we do not mean to assert; but the peculiar simplicity of his character is necessarily rare, in a highly cultivated age like the present, "when the progress of refinement has worn down society into a more smooth and polished, but certainly a less characteristic surface;" and the complete change which manners and habits of thought have undergone, renders the biography of Herbert and such as Herbert, interesting, even independently of their piety, but taken with that important addition, such a life becomes a valuable example, and one, which notwithstanding the difference of the times, there is still ample opportunity to imitate.

"G. Herbert," observes Mr. Coleridge, "is a true poet, but a poet *sui generis*, the merits of whose poems will never be felt without sympathy with the mind and character of the man. To appreciate this volume, it is not enough that the reader possesses a cultivated judgment, classical taste, or even poetic sensibility, unless he be likewise a *Christian*, and both a zealous and an orthodox, both a devout and a *devotional* Christian. But even this will not quite suffice. He must be an affectionate and dutiful child of the church; and from habit, conviction, and a constitutional predisposition to ceremoniousness, in piety as in manners, find her forms and ordinances aids of religion, not sources of formality; for religion is the element in which he lives, and the region in which he moves."

This adherence to what has been happily called the "patristic leaven," will be understood by those who know what affection, what animation, is found in the first writers of the Christian church, with what delight they dwell upon the order exhibited in the Christian plan, and comment upon the peculiar wisdom and simplicity of the word of God.

From the faults of his day Herbert seems to have been preserved, without being exactly aware of their variance with true poetry. His sense of religion disinclined him from the employment of Venuses and Cupids, and all the machinery of the pagan heaven, and thus cut off an ordinary and fruitful source of allegory and false taste; and he avowed his contempt for amorous ditties at a time when, says Cowley, "poets were scarce thought freemen of their company without paying some duties, or obliging themselves to be true to love." He indulged in no poem of fancy, strictly so called, his muse following an order prescribed by his piety and his respect for his church.

His precepts are not unfrequently clogged by his verse, and would far more appropriately have become a sermon. He often forgets that a similie should either illustrate or elevate the subject, and his figurative language occasionally impairs the effect of his fervour by giving it an appearance of insincerity. Far inferior to his contemporary Carew in freedom of style, and to his predecessor Drayton in rough grandeur, more chaste than Suckling, less severe, but less witty than Hall, and far less so than his friend Donne, his piety, quite as much as his poetry, has been considered as the charm of his song, and the genuine love to God and man which is manifest

in all his writings, has ever procured him a considerable number of admirers, while the names of far superior poets have fallen into oblivion. His poems have an advantage in not being occasional, for occasional poems cannot expect other than occasional praise.

It was said of Thompson, that his ruling ideas were poetical, and that he could not see two candles burning without the suggestion of a poetical image. Herbert, in like manner, made every incident subservient to his religious impressions, and his manner of introducing them, though sometimes forced, is at others very pretty; thus, in the lines called "Life," p. 94, after describing in the two first stanzas the short duration of a nosegay of flowers, he goes on in the last,

> Farewell dear flowers, sweetly your time ye spent,
> Fit, while ye lived, for smell or ornament,
> And after death for cures:
> I follow straight without complaints or grief,
> Since, if my scent be good, I care not if
> It be as short as yours.

The learning of Herbert was, we are told, considerable, but notwithstanding his connexion with James he had the judgment rarely to obtrude it; his allusions are seldom pedantic, and his occasional obscurity depends rather upon his versification than his learning, upon the inversion of his style and the obsolete signification of his words, than upon any hidden connexion between his ideas.

In his time the example of Donne had only begun to produce its effects, and metaphysical poetry had not reached the celebrity which it subsequently obtained from Cowley. Like the metaphysical poets, however, Herbert was a very close observer of nature, and drew his figures from a great variety of sources, though chiefly from the scriptures. In some of his lines ideas remote enough are connected, and resemblances discovered with painful ingenuity. To shew his learning was not indeed his aim, but his figures are occasionally scholastic and unnatural, and he sometimes hunts about for a metaphor which when found is rather a blemish than a beauty. He pleases most when he takes least pains to please.

We shall point out some few passages from his writings in support of the above remarks, and we limit our citations the more readily that the volume before us may very readily be consulted, as its cost is reasonable.

The Perihanterium, or Church Porch, which precedes his other poems, is rather a collection of rules and aphorisms than a poem; considered as such it is admirable, and its delivery in verse is at least convenient. It is the whole duty of man paraphrased and versified.

Sometimes he plays upon words, though hardly amounting to a pun:

> When my dear friend could write no more,
> He gave this seal, and so gave o'er.

Or, speaking of the crucifixion,

> Man stole the fruit, but I must climb the tree.—p. 26.

Sometimes he indulges in a conceit, as, respecting the third glass of wine, he says,

> It is most just to throw that on the ground
> Which would throw me there, if I keep the round.—p. 2.

His conceits are occasionally forced, as,

> Since blood is fittest, Lord, to write
> Thy sorrows in, and bloody fight;
> My heart hath store; write there, where in
> One box doth lie both ink and sin.—p. 32.

Or,

> The cross taught all wood to resound his name.

Or,

> They gave me vinegar mingled with gall,
> But more with malice.—p. 27.

Sometimes his conceits are mean, as,

> Arise, arise:
> And with his burial linen dry thine eyes.
> Christ left his grave-clothes, that we might, when grief
> Draws tears, or blood, not want a handkerchief.—p. 114.

Often, however, his conceits are better imagined and very well introduced, thus:

> The Sundays of man's life
> Threaded together on time's string,
> Make bracelets to adorn the wife
> Of the eternal, glorious King.—p. 73.

He does not, however, on the whole, make so much of these licences as he might have done; their management was perfected by Cowley, and very happily carried on by some of the poets of the succeeding century. One of the most beautiful instances of a conceit which we remember to have met with occurs in the epitaph on Samuel Bolton, by Standish, 1654, and is so little known that we are tempted to transcribe it.

> Stay, reader, and bestow a tear,
> On this dusty, fruitful bed,
> The spring will then dwell always here,
> And violets ne'er hang the head.
> Pray the earth may lightly press
> Her entrusted urn below,
> May the same prayer thy reliques bless,
> When they rest as his do now.*

Herbert sometimes compares things incomparable, which do not admit of comparison, as,

> ——————— did the ointment prize,
> Not half so sweet as my sweet sacrifice.—p. 19.

* Clark's Lives, p. 45, folio 1683.

Sometimes his allusions are forced,

> Behold they spit on me in scornful wise;
> Who by my spittle gave the blind man eyes,
> Leaving his blindness to mine enemies.—p. 23.

And sometimes disgusting, as at p. 160, where the wound made at the crucifixion is compared to a bag, in which prayers and petitions are to be put.

Like Cowley, he is not always free from the introduction of unclean images; thus, p. 40, we have affliction as "his sweetened pill;" and in the next stanza, this "purge" is "turned to food;" and at p. 38, we have a metaphorical plaster, and in the next piece a blister, by way of similitude. These pharmaceutical figures are always unpoetical.

But his metaphors are now and then well chosen and just, and consistently preserved: this is particularly the case in the "British Church," p. 111, one of his happiest productions.

"The Rose," p. 189, beginning, "Press me not to take more pleasure," is easy both in metre and style, though it becomes too medical towards the close.

The conclusion of "Easter,"—"I got me flowers to strew thy way," p. 35, is exquisitely beautiful, and the allusion to an ancient custom very happy.

The lines,

> Give my captive soul, or take
> My body also thither, (p. 47,)

reminds us of "Take, Oh take those lips away."

The first, second, fourth, and last stanzas of "Content," p. 65, are in his best manner, as is "Virtue," p. 87; the first stanza especially is highly poetical.

> Sweet day, so cool, so calm, so bright,
> The bridal of the earth and sky,
> The dew shall weep thy fall to night;
> For thou must die.

The "Church Floor," p. 63, combines most of Herbert's peculiarities, and is remarkably well fitted for imitation. His piety often shews itself towards the end, and he rather delights in the sudden transition. Sometimes he is energetic, concise, and free from quips, as in the "Reprisal," p. 29, and sometimes his expressions are very original, as

> Prayers chased syllogisms into their den,
> And "Ergo" was transformed into "Amen."

And, p. 61,

> To sever the good fellowship of dust,
> And spoil the meeting.

"The Sacrifice" is rather a liturgical narrative of Christ's sufferings than a poem.

But if Herbert was inferior in poetry to the masters of his art, he was their superior in truth. His transports were real, theirs were feigned; his celebrated a heavenly, theirs an earthly object; his goddess was truth, their idol was fiction. He indulged not in visions or speculations; his time, at

school, at college, and in after life, was well employed, and his industry was honorably rewarded.

In his poetry, tried even by the scale of the present day, there is little that is coarse or indelicate, and nothing lascivious, which, considering the age upon the threshhold of which he lived, is no ordinary distinction.

Those who have attempted to modernize Herbert, have failed. His quaintness is peculiar, and his conceits are incorporated into the structure of his verse. He is like the buildings of his day; their lofty gables and grotesque porches are not perhaps in strict accordance with the rules either of Grecian or Gothic taste; but they have nevertheless a charm of their own, and will bear neither alteration nor improvement.

And here we must conclude, having drawn out this article to a far greater length than we had intended; but we were unwilling to let slip the opportunity which the appearance of this volume afforded us, of drawing, according to our limited sphere, some portion of attention to an old and admirable writer.

An Attempt to Discriminate the Styles of Architecture in England, from the Conquest to the Reformation, &c. By Thos. Rickman, F. A. S. Architect. 8*vo. pp.* 339, 1835. *Fourth Edition.*

With the general drift of this volume, we shall assume that our readers, during the progress of its three previous editions, have become acquainted. No writer before Mr. Rickman has ever applied himself with such signal success to the discrimination of the styles of Gothic architecture, or defined the terms employed in his descriptions with equal accuracy.

Considerable, and in some respects well-founded, objections have been raised against the employment of the terms Decorated and Perpendicular, as descriptive of the two later styles of architecture prevalent in England between the reigns of Edward II. and Henry VIII.; and certainly any one who looks at such towers as that of St. Stephen's, in Bristol, will be quite as much struck by its horizontal as by its perpendicular lines; but these terms seem to have been adopted rather to mark the contrast between the later and the preceding style, an object which they certainly fulfil. Besides which no one has hitherto succeeded in substituting for them others less exceptionable, or defined with an accuracy at all to compare with that of Mr. Rickman, who has shewn that architecture is as susceptible of the advantages of a copious and well-defined nomenclature, as any natural science. Those only can duly appreciate the value of a book like this, who remember the thick darkness which overspread architectural topography during the last century, in those days when the speculations of King passed for authority.

The present edition, besides a new set of plates, contains two new and interesting sections, the one upon "such buildings as may be presumed to have been erected in England before the Norman conquest," and the other "upon the architecture of a part of France."

Under the former head Mr. Rickman enumerates twenty churches, in the northern, eastern, and southern parts of the kingdom, two only, North Burcombe and Brytford, having been observed as far west as Wiltshire. It is remarkable that out of these twenty ante-conquistal edifices, the names of seven commence with B.

The characteristic of these ancient buildings are the coigns of what Mr. Rickman calls "long and short masonry," that is to say, composed of longer vertical and shorter horizontal stones, placed alternately.

Not the least valuable portion of the volume is the appendix, containing a list of the principal buildings in each county, with a concise and critical notice of what is remarkable in each.

Mr. Rickman seems jealous of this part of his book, lest it should degenerate into a gazetteer. We wish, on the contrary, that it had been amplified. Certainly the best means of ensuring the general adoption of a system of classification, is to place within the reach of every one the means of applying it to as many examples as possible.

It is to be wished also that Mr. Rickman had enlarged upon those more minute details upon which deductions concerning the precise age of buildings must rest. Many of the churches around us present mouldings very different from those by which the style may be elsewhere characterised, and the transitions between the early English and the decorated, manifested in Bristol cathedral, Keynsham church, &c. seem especially to deserve more notice than they have received.

Mr. Rickman's work has supplied one great desideratum—but there is still needed a work upon the geometry of architecture; an analytical estimate of the degree of geometrical skill possessed by the monastic architects, whether they ever employed too great a quantity of material in their walls and buttresses, and by what means they determined the direction of the curve of support, so as securely to remove the extraneous parts of a buttress.

[IN THE PRESS,]

The History and Antiquities of Somersetshire, by the Rev. W. Phelps, Vicar of Meare. 4*to.* 4 *vols.*

If our readers will turn to the advertisements upon the wrapper of this number, they will find there the announcement of a new county History of Somerset, by Mr. Phelps.

Whatever may have been the merits of previous histories, there can be no question but that such a work is very much to be desired, not for Somerset only, but for almost every county in Great Britain. The History of Leicestershire, by Mr. Nichols, and that of Durham, by the late Mr. Surtees, are by far the first of such works; the former for extraordinary copiousness of detail and number of engravings, and the latter for its accuracy and the high and lucid style of its composition. The History

of Durham is one of the very limited number of county histories the matter of which need never be re-arranged. The history of the bishops of Durham, forming the first part of Mr. Surtees's work, is interesting even to those who feel but little disposition to read topographical details, however accurate, and will we trust be borne in mind by Mr. Phelps, in that section of his work which he promises to occupy by an "ecclesiastical history of the diocese."

We rejoice to find Geology among the subjects included by Mr. Phelps, and we trust that the organic remains will also be enumerated, since geological strata without fossils are very much in the condition of a volume containing nothing but blank leaves.

The subjects embraced by the "historical introduction" are abundantly interesting, and present an ample field for the exercise of learning and judgment on the part of the author; great light has of late years been thrown upon the Belgic and Roman antiquities of our counties, much false and absurd hypothesis has been overthrown, and many fair and safe deductions established in its stead; many works once supposed to be Belgic have been shewn to be Roman, and many antiquities, formerly attributed to the Saxons, have been restored to their legitimate authors, the Normans. Of these changes no comprehensive view has yet been given to the public.

We trust also, that in an historical introduction, the valuable deductions from Philology will find a place; that attention will be paid to the names of the physical features of the country, and especially of its minuter watercourses. This subject has hitherto been much neglected. The new registration act also affords great facilities for the classification and comparison of the names of persons, a subject to which but little attention has been paid since the days of Camden.

There is besides another, and that a very important point, to the illustration of which we look forward—Architecture. Somerset is one of the richest English counties in architectural splendour; it contains towers, many of which are among the noblest specimens of Gothic art; and it is peculiarly rich in stone pulpits, crosses, and baptismal fonts. To the description of such works, every lover of Gothic Architecture will look forward with pleasure. Let us hope that instead of the loose and undefined terms which have ever disgraced the pages of topographers, we shall find employed the concise and intelligible phraseology of Rickman. It has been shewn to be possible to describe a building as a botanist describes a plant, so that a drawing of it may be executed from the description, and the nomenclature of ecclesiastical Architecture is sufficiently ample.

But we must conclude. Our readers need not be reminded that a county history is somewhat of a patriotic undertaking, and therefore that it has a claim upon the support even of those whose pursuits may not lead them to derive any direct advantage from its contents.

British and Roman Remains at Axminster. By T. Davidson. 8*vo.* 1833. *pp.* 90.

This is a small and unpretending volume, in which the British and Roman remains abounding in the immediate neighbourhood of Axminster, are concisely described.

Within twenty-five miles of Axminster there are thirty hill camps; of these, Musbury and Membury are among the most important, since they form part of a chain of strong-holds, extending from the sea inland, nearly along the border of the counties of Dorset and Devon. These camps have been usually supposed to have been thrown up by the Damnonii, or people of Devon, to guard their frontier; but Mr. Davidson has observed that the approaches to them, traces of habitation, etc. are all upon the eastern side; and hence he concludes, that they were thrown up against the Damnonii, by the Morini. At Blackbury, towards Honiton, is a beacon, placed outside an oval entrenchment; the walls of the beacon are vitrified, and some spear heads, apparently Roman, have been dug up here.

Mr. Davidson gives some general directions, which deserve attention. Thus, if we wish to discover tracks, remains of roads, camps, or other inequalities in the soil, we should choose a clear winter's day, when the last of the snow is on the ground. Mr. Hamilton's success with the inscription on the column of Dioclesian, and the late discoveries which the continued dry weather enabled Mr. Hatcher* to make within the precinct of Old Sarum, are proofs of what may be gained by making use of such advantages.

It is much to be desired, that those who have the means of acquiring local information, would thus benefit the public with the fruits of their researches. It is only from a number of facts thus obtained, that any just general conclusions upon these subjects can be arrived at.

* Gentleman's Magazine, p. 143, August, 1835.

DISCOVERY OF THE SCITE OF PRIOR'S-HILL REDOUBT.

Those who are conversant with the history of Bristol are aware, that during the early part of the reign of Charles I. considerable attention was paid to the defences of that city, the importance of which in the event of civil war had apparently been foreseen.

The castle, town-walls, and gates, the old feudal defences of the city, not having been deemed sufficient, additional lines were thrown up, better suited to the warfare of the period, and to the species of attack by which they were liable to be assailed.

These defences, on the north-western or land side, were concentrated upon five points, called in the language of fortification "redoubts," which were connected together by covered ways or lines.

The ground occupied by these fortifications is a long ridge, rising abruptly from the Avon to form Brandon Hill, and terminating also abruptly at Kingsdown, on the north.

In the centre of this line, upon St. Michael's Hill, was thrown up St. Michael's, or the Windmill Redoubt, which was subsequently enlarged and converted into a regular pentagonal fort, and is usually mentioned in the transactions of the period as the "Royal Fort." From hence, on the left, a covered way passed down the hill, crossed the present road a little above the top of Park Street, and passing diagonally across the ground on which Berkeley Square now stands, terminated in the Brandon Redoubt, which still crowns the hill of that name. From hence the line descended towards the Avon, and just at the bottom of Limekiln Lane terminated in the "Water Redoubt," beyond which, recommencing, it finally terminated a few yards further on, in the river.

A similar line of defence extended itself in a contrary direction, guarded also by two redoubts, one behind the present Montague Parade, called "Colston's Mount," and the other upon a hill formerly belonging to the priory of St. James, Prior's Hill.

The lines were thus strengthened by a central fort, two flanking and two intermediate redoubts.

During the siege of Bristol, first by the royal, and afterwards by the parliamentary party, these works, and more especially their extreme flanks, became points of great importance, and no pains were spared, both to take and to defend them.

The redoubt on Prior's Hill, in particular, was the scene of many fierce skirmishes; and after having been battered from the adjacent hill (Montpelier) by Cromwell and Fairfax in person, was finally taken by storm, and the greater number of its defenders put to the sword.

This redoubt then, upon the loss of which the city surrendered, is in some measure identified with its history; but its exact scite had fallen into oblivion.

A few weeks since, some labourers employed in cutting a new road, in what is called "Mother Pugsley's field,"* directly opposite to the north wing of the last house in Somerset Street, discovered a considerable number of leaden bullets, slugs, and tobacco-pipe bowls. The bullets were of twelve to the pound, some flattened, having being fired, and others unused. The bowls belonged to a kind of pipe called, from its resemblance to the head and bill of that bird, the "woodcock's-head pipe." The bowls are small, thick, and globular; and round their margin is a narrow milled

* Pugsley was the owner of the field in which the work stood, and held a command under Prince Rupert. He was shot in or near the fort, and was buried where he fell, with military honours. His widow died in 1700, at the age of eighty: she was remarkable for her attachment to the memory of her husband, and for the excentricity of her funeral.

ring. The shanks have been broken off close, but their axis has more nearly coincided with the axis of the bowl than is now usual.

The size of the balls, fashion of the pipes, quantity of both, and the place in which they were found, may be considered as establishing the the scite of the "Prior's Hill Redoubt" beyond dispute; for which reason only we have thought it necessary to advert to the above circumstances.

POETRY.

LINES ON SEEING MR. BAILY'S STATUE OF "EVE AT THE FOUNTAIN,"

IN THE BRISTOL INSTITUTION.

Fresh from heaven, its fairest creature,
First of woman's winning race;
Innocence in every feature,
Sweetness, tenderness, and grace.
Nature's all-accomplished daughter;
See, she bends in fond amaze,
While her image in the water
Charms her lone and lovely gaze.

Happy sculptor! thy creation
Gives to sight the matchless Eve,
Milton's bright imagination
Meant us, listening, to conceive.
Venus in her pagan glory,
Sung by Byron, what is she,
Eve of Milton's hallowed story,
Eden's Eve, compar'd with thee?

Clifton, *June* 4, 1835. T. G.

MORNING.

——— Awake! awake!
The lark sings lustily, and the glad morn,
Young, dewy-crested, and with verdure crown'd,
Is up and on his progress towards mid-day.
Within the circle of his coronal,
Health, a glad guest, sits smiling; around him
Peace waves her olive wand abroad, and pours
The treasures of his horn, Prosperity:
Nature with her chief works hath risen to meet him;
Chiefest of all, the life-infusing sun,
His eastern couch and ebon bride hath spurned,
And shines a real vision of bright gold.
Up, up! who that hath tasted of the scene,
Or viewed creation in her chief aspect,

Would, like a base clod of the valley, lie
Outstretched in slumber ?
Hark, hark ! the chase is up, the blythe hounds bay
A chorus to the hunter's melody.

NOTICES TO CORRESPONDENTS.

We cannot consistently with the principles to which we are pledged by our address, insert the "Latin Translation" of Etonensis. The tendency of the poem is simply to excite the passions, without any reference to time, place, or motive. Neither is it so highly polished as might have been expected from the shortness of the poem and the school of the writer. We could wish that he had dipped a little more deeply into his original author, and selected—no very difficult task—a poem of a higher and nobler character.

We have received, from a correspondent at a considerable distance, the following communications. The first was an article signed—we shall say X. Y.—which, as we could not insert in our present number, we returned, at its author's request. Within a day or two, we received from the individual to whose care the first had been committed, two further communications, in his own proper person. Of these one was a paper which we should have had no objection to insert, had we found room, in the present number ; the other was a review of a periodical journal, to which our correspondent and his friend X. Y. have largely contributed, and in the management of which they seem, from their letters, to have some concern. The reviewer, whose review, by the way, is grossly deficient both in grammar and that which, in the absence of a more appropriate word, we must call style, ("as is," for "which is," &c.) after praising generally the periodical in question, proceeds to speak of his friends and *his own* contributions in terms which no man of common modesty would apply even in thought to his own writings, and no man of judgment to many of the writings of other people. In this review also the editor is praised, and possibly very justly, for *impartiality*.

A few days after the receipt of this, appeared another letter, urging on the immediate publication of the papers, and concluding with the following paragraph, underlined as we here give it: "*If my paper and review appear in your* October Number, it is my intention to spread that number far and near; and I have with difficulty prevailed on many of my friends to procure it, which they will only do *if these are published.*—P. S. If you print my notice of the ——— (the periodical reviewed) I will review your own journal in some of the best periodicals of the day." And in another place he writes, "Should these two papers appear in your next number, I intend to take a dozen or more copies of it, to distribute to my friends. I take thirty copies of the ———."

Now it is contrary, both to our wishes and our policy, to hurt the feelings of any man, and therefore we withhold names and even initials, but we feel called upon openly to reject the correspondence and pecuniary support of a person who is so grossly deficient in morality as to attempt thus to bribe our administration of that praise or censure, of that *impartiality*, of the duty of which his own letters shew him to be aware, and for the discharge of which, be their influence impotent or powerful, editors of reviews and those who assist them, are heavily and solemnly responsible.

The editor of this journal is perfectly at a loss to conceive from the perusal of which of his writings this person has been induced to offer him this degrading insult.

J. CHILCOTT, PRINTER, WINE STREET, BRISTOL.

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PART II.—LITERATURE.

ESSAY TOWARDS A GRAMMAR OF THE BERBER LANGUAGE.

BY F. W. NEWMAN.

In attempting to redeem the promise made in our third number, to give some account of the Berber language, we have to contend with many difficulties. If it were possible from twelve chapters of St. Luke* (our *sole* source of information), to lay down all the details of a grammatical system; yet we should hardly expect to gain attention. Nor will our end be attained, unless we can set something before the reader, which will enable him to form some judgment for himself on the matter in hand.

A difficulty also arises in the employment of European characters. The Berber language has nearly the Arabic or Persian letters. It is necessary for our present object to exhibit these in a form readily intelligible to our readers: and after considering the various objections raised by the printer against other devices, it seemed best to have recourse to the Greek alphabet.

Attention then must be paid to the following system of consonants:

δ is as in Greek—or English *th* in *thus*.

θ —or *th* in *thing*.

γ nearly as *gh* in Irish *Drogheda*.

χ almost as in Greek, being a strong wheezing *h*.

x is rougher still, as in Spanish; being the roughest German *ch*.

q is a deep sounded *k*, formed at the root of the tongue.

j is as in French.

c is as English *sh*.

τ is Hebrew ט, a hard palatal *t*.

σ is Hebrew ע, a mouthing *s*.

* Extrait d'une Traduction MS. en langue Berbère,...contenant XII. Chapitres de St. Luc. A Londres; aux frais de la Société Biblique Britannique et Etrangère. The character in which this is printed, is that of the Western Arabs, being a very slight modification of the alphabet of the Korân.

The Arabs have two letters for each of the two last; but in this respect the Berber seems to agree more with the Hebrew.

The letter ε we have adopted from the Arabic, as there is no European substitute. It denotes an emphatic jerk of the voice, not unlike that which a stuttering person often prefixes to his vowel sounds.

It remains to express the English *j* and *tch*, which are really double letters. Since indeed the characters are single in the foreign alphabet, it would certainly be better to have peculiar substitutes; and we should prefer *g* and *k*, each with two dots above, as Egyptian *Gimel* and *Kaf* are by the Bedouins sounded *Djimel* and *Tchaf*. At present, however, we shall use *dj* and *tc*, each consonant having its own sound as above explained.

Concerning vowels, it is enough to say that they are to be sounded as in Italian, and that the accent (') indicates their prolongation. In the Arabic notation there is a deficiency of short vowels.

The textual orthography abounds in duplicate letters (as in *aggakkanni)*, which appear generally to be euphonic. Where the Arabic sign of reduplication is placed over a solar letter, after the article *El*, we have omitted it; but where the translator seems to have used this mode of writing by mere error (which is very common), the pronunciation which he indicates, has been expressed in our characters.

The aspirates *δ*, *θ*, as in Hebrew, so in Berber, refuse reduplication; so that *δδ*, *θθ*, are changed to *dd*, *tt*. Also *nθ* seems uniformly to become *nt*, as *Entaklis* for *enθaklis*; *Entagnò* for *Enθagnò*, &c. The distribution of vowels and consonants is regulated nearly as in the Shemitic languages. Yet three consonants are sometimes found together in the middle of a word. The following consonants are occasionally confounded: j and tc; j and g; dj and g; ε and q; γ and q; x and χ; σ and s; δ and d; t and θ. Sometimes we cannot tell what allowance to make for possible errors of the press.

We proceed to exhibit the Lord's prayer, as it is found in the beginning of Chapter XI.

(1.) *Aggakkanni natta etzalla aggamkàn, akkanni ifok, ennayàs*
At-when he prayed at a place, when he finished, said-to-

yiwan agθarbaεθes; A Rabbi, ayaγesen annazàl, akkanni
him one from-his-disciples; Oh Lord, us-tell (that) we pray, as

iskon Yùχana δaγanni θarbaεθes.
taught John also his-disciples.

(2) *Ennayàs: Maδayalla θazzullam, eniθes: A Bàba,*
He-said-to-him: When ye-pray, say-ye-to-him: O Father,

aδiskar ismek nattaboθ; addusan el-malayk enek: (3) *aγrom*
let-become thy-name holy; let-come the kingdom of thee: bread

ennaγ icaraξ efkaγ assayyi: (4) *Aξfoyaγ azyaδa ennaγ; aqlaγ*
of-us sufficient (?) give-us to-day. Forgive-us sin of-us; behold-

δaγanni annaξfo akra awinna illan ennaγ. Oraγassakcam*
we also we-forgive all that were ours. Do-not-us-bring-into

accak.
trial. (?)

So the Lord's prayer ends in this version, being yet more defective than in the Vulgate, from which, however, we apprehend it must have been taken. Indeed,† in ch. ii. 14. the words agree with the Latin, *pax hominibus bonæ voluntatis.*

To open the character of the grammar, it is proposed to analyse the above, word by word.

(1) *Aggakkanni.—Ag*, from; *Akkanni*, or *Akanni*, when. *Akanni* is found written *Akayenni;* from *Ka* (according to) which is Hebrew, &c. and *Anni* or *Ayenni* (this).

Etzalla, "precetur, precaretur."—Root, *izal*, he prayed.

Aggamkàn.—Ag, from; and *Makàn*, [Arab.] place.

Ifok.—Root, *Fakk*, [Arab. he pulled out] he delivered, set free, finished, or left off. These meanings are nearly found combined in the Latin *absolvo*, and Arabic *Xalaσ*.

Ennayàs, he said to him (or her). The radical part of the verb Say, appears to be *Eny* or *Wenyà*. Compare the following.

Enni, say thou,—command thou.
Eniθ, say ye,—tell ye. *Eniθes*, say ye to him.
Ennàn, *Eniyàn*, } they said. *Ennanàs*, they said to him (or her).
Ennayàs, he said to him.
Ennayàsan, he said to them. *Θennayàs*, she said to him.

Yiwan, one; fem. *yiwaθ*. This is the only numeral which is not Arabic.

Agθarbaξθes.—Ag, from; *θarbaξθ*, discipline or disciples; *es*, of him. The Arabic *Arbaξ*, four, seems to take in its Berber derivatives the notion of regularity, derived from that of squareness. Hence *Warbaξ*, a soldier (Luke iii. 14). *Θarbaξθ*, discipline (i. 5), and lineage (ii. 4). Here, and constantly, disciples. A collective feminine singular for a masculine plural is on the Arabic model. The reader will observe the servile θ prefixed and postfixed, to make a feminine noun.

A Rabbi, Oh Lord. The word *Rabbi* seems ordinarily used for

* Something in the text appears to be wanting.

† They run thus: *Aγfal-qaξa δaslàm emmaddan iyyàn ibγàn anfaξ*
On the earth peace of men who choose usefully; i. e. have proper sentiments.

"God," and to be confined to God and Christ. This sense of the word is not Hebrew, but Arabic.

Ayayesen.—*Ayaγ*, us; pronoun prefix; *Esen*, tell. Of the verb *Esen* are found,

Eseniγ, I say; *Esennan*, they spake; *Esyini*, saying.

It is probably a compound; of *Es* or *As*, in; and *Eny*, say: and it is hardly distinguishable from *Sin*, to know.

Annazàl, precemur, precaremur. Root, *Zal*. Possibly, however, *Annazàl* is *El-nazàl*, the act of prayer.

Iskon, he beckoned (i. 22), pointed with the finger, showed, taught.

(2) *Maδayalla* or *Mayalla*, *Mayal*; when, forasmuch as, if. *Maδay* is used for If (iv. 3). The element *iδa* (found also in *eniδa*, where; *iδak*, who, which) seems to be Arabic.

Θazzullam, still a subjunctive, like *Etzalla* above; but *m* final indicates second per. pl. So we find *astaqqaram*, ye shall call; *attassiggam*, ye may behold; *oraθbaddom*, do not begin (ye).

Aδiskar, may become, shall become. *Iskar* is active or neuter, κατέστησα and κατέστην. The root is *Akkar*, to stand up. "Mary *laid* her child in a manger:" *isakrit*. "His parents went that *they might present* him to the Lord:" *aθassakran*. "They brought him that *they might do* with him according to the custom of the law:" *aδsakran*. The prefix *aδ* in verbs, indicates the Hebrew future (as we call it), in the third per. masc. sing. and of the third per. pl. *Aδ* or *Eδ* has also another meaning when prefixed to nouns, which will be noticed hereafter.

Ismek, name of thee;—is pure Arabic.

Nattaboθ, epithet of the Spirit and of the gospel. Literally, it is probably *Na*, of; *Taboθ*, holiness. In i. 35, "that holy thing" is expressed by *Δattaboθ*; elsewhere *Attaboθ*.

Addusan, for *Aδδusan*, the same as *Aδyusan*. It is a plural form, and often occurs as such—Veniant.

Enek, of thee. *En* or *Na*, of.

(3) *Ennaγ* or *Ennoγ*.—*En*, of; *Naγ*, pron. suff. first pers. pl. from *Nakni*, we.

IcataΞ answers to ἐπιούσιον, and we are unable to say how the Berber translator understood it.

Efkaγ.—*Efka*, give; *γ*, (suff. pr.) us. The root *efka* must be distinguished, as pure Berber, from *fakk*, noticed above. *Efqa* is also found for *Efka*.

Assayyi.—*As*, generally *Os*, day; and *Ayyi*, this. *Ayyi*, when an adjective, follows its substantive. When put absolutely, as a substantive itself, it changes to *Wayyi*. A like distinction exists between *Inni*, that, and *Winni*, that person, that one.

(4) *AΞfoyaγ*.—*AΞfoy*, [Arab.] forgive; *aγ*, us.

Azyada.—Observe, in Arabic, *Ziyad* means "excess," "surplus," &c. not "sin;" but the Hebrew root *Zìd*, "to sin boldly," gives the Berber notion.

Aqlay.—*Aqla* often introduces the apodosis of a sentence, and is prefixed to suffix pronouns. It may sometimes be translated, *Behold*, and sometimes *For*. As a verb, it means Turn, or Return.

Annaɛfo.—Compare *Annazàl* (above). The prefix *anna* makes the first per. pl. of the subjunctive or future.—Thus, *Aço annaxðam*, what shall we do?

Orayassakcam.—*Or*, prefixed, No, Not. *Ay*, us. *As*, in. *Akcam*, enter.—The compound *Asakcam* means "bring, bring in." This is an imitation of Arabic grammar, as is proved by the fact that the preposition is found *after* the verb in this same sense: as, *Osand as-wergaz*, venerunt in homine, that is, fecerunt venire hominem. Indeed, *as* compounded with a root ordinarily produces a transitive verb, as will be hereafter seen.

As a difficult specimen of Luke's style, we subjoin the four verses with which he introduces his history; and to explain the grammar more compactly, our translation is into Latin.

(1) *Ayfassabba allan xiralla zaðman aðhadran ayanni fokkan*
Supercausam plurimi suscepêrunt narrent eaquæ absoluta

ðagnay. (2) *Akkanni ayin inakni, wiðak illan agbakri*
sunt internos. Prout accepêre nobis, qui erant ab initio

zarran, allan aθqadcan lahðir. (3) *Azriy nakki ðayanni, maðayalla*
vidêrunt, ministrent verbum. Vidi ego quoque, quoniam

alliy attafaray akra-yallan agbakri somanyi, maðayalla asrasyad
fui sequor omnia ab initio accurate (?) quòd scribam

yorek, A Tàùfilu ðelɛàli; (4) **Atettinat, akkanni ixaddam lahðir,*
tibi, O Theophile bone; (Ut) scias, secundùm actionem verbi,

enni akaðhadray.
quod tibi narro. (Not very close to the Greek.)

The construction *erant vidêrunt* for the pluperfect *viderant*, is an Arabism. Also *fui sequor* seems to express our tense, *I have followed.*

The word *allan* occurs pretty often; but we have not succeeded in fixing its meaning. It is added to particles much as *Kàn* (it was) in Arabic; and is probably connected in etymology with *Illa.* But we suspect it is sometimes a relative.

This passage also will show the reader:

The second per. sing. terminating in *at*.
The first per. sing. terminating in *ay* or *iy*.
The third pers. pl. in *an*.

* This seems to be a misprint for *atessinat*. The difference is only that of three dots for two.

In fact, the *n* final seems to indicate plurality, alike in verbs, nouns, and pronouns. Nay, in some cases *an* seems to be a masculine plural, and *ant* a feminine plural. Thus in Luke iv. 26, 27, *Of them* is expressed by *Azzagsant*, when speaking of the widows; and by *Azzagsan*, when speaking of the lepers; though each is followed by the same sound.

But here we must stop, for fear of misleading the reader. The truth is, that the laws of concord (as *we* view concord) are so pertinaciously violated by Asiatic and African languages, that it is hardly possible to know what is feminine, what masculine, what singular, and what plural.

For nouns there is no complex system of declensions. There are undoubtedly *cases*, formed by a prefix; and these prefixes occasionally modify the syllabification of the noun, as in Hebrew. The cases are as follows:—

Rabbi, Lord God	*Bàba*, father, master
el Rabbi, *er Rabbi*, the Lord, or, of the Lord	*Em bàba* (for *En bàba*), of the father
Il Rabbi, *Irabbi*, to God	*Ibàba*, to the father
Eδ rabbi, *Δa rabbi*, God (accus.)	*Eδ bàba*, the father (accus.)

The particle *En* or *N*, which forms the genitive, seems not to be readily used with proper* Arabic words; but in the latter the Arabic article *El* suffices, and the word is to be supposed in construction with that preceding. Some few nouns have a construct form; as *Bàbaθ* before a suffix pronoun. Observing: that the genitive is expressed by *el*, before, not Arabic words only, but some Berber words; that it is *ey* or *eyy* before many vowels; that it is *em* before words beginning with B, M, L; and that it is generally before D, T, S, C, that *en* is found: the suspicion will rise, that all are euphonic variations of *El*. Yet N before a vowel can have no such explanation; as *Enaw*, of me, *Enak*, of thee; *Amaqràn narbaξ*, Lord of the quarter; i. e. Tetrarch: *Θamaττoθ nagmas*, wife of his brother; from *Agma*, brother.

What we have called the accusative, is the accusative of Eastern rather than of Western grammar: and a student would often be misled, if he expected to find a coincidence. In fact, the similarity both of sound and of usage, between *Eδ* or אד and the Hebrew את, is such as cannot be accidental. For, *first*, each of them is equivalent to the preposition With: (as, Joseph went *with* Mary, *eδ Mariam:* and *next*, each indicates the accusative case. This accusative seems principally employed, (1) in pure logical propositions, as the predicate; (2) with the latter of two nouns which are in apposition;†—whether they refer to different subjects or not; (3) to give emphasis.

* Even in ii. 26, "The Lord's Christ," is rendered *El Mesìχ el Rabbi;* which might equally mean "Christ the Lord," as *v.* 11 of the same chapter shows.

† The Attic idiom shows traces of this orientalism, making the accusative *the case of apposition;*—

Since in Berber, as in many rude languages, (indeed in the Turkish,) there is no conjunction And, it is natural to use With, to supply the want. In some cases, it is hard to know whether *Eδ* means "with," or indicates apposition. Thus it says of Zacharias, Luke i. 64.—

Ilda yim-es ag-θiramt-es, eδ yils-es.
Opened his-mouth at-its-instant, *with* his-tongue.

In apposition again, thus: (i. 32:) *Mandjar Daùda, eδ bàbas;* the seat of David, his father.

Finally, in some cases *eδ* seems confounded with a genitive; i. 68:—

Δel-ℰàliθ el-Rabbi eδ Israèl.
Blessed (is) the Lord God *of* Israel.

ℰàli means Good, in the widest sense; (as in vi. 45, *ergaz el ℰàli,* the good man,) and hence, Happy, Blessed. The Δ prefixed to *el ℰàli* indicates the word to be a predicate; the final *θ* is, by all analogy, a feminine termination, which Elizabeth rightly applied to Mary, (i. 42,) and which is as rightly omitted when Luke calls Theophilus *excellent.* This *θ* is also omitted in the general addresses of vi. 21, 22. Probably *ℰàliθ* is here an abstract noun, Blessedness.

Possibly *eδ Israèl* may be interpreted *apud Israelem,* but the sense required is that of a mere genitive. So *Eδsan* for *Ensan,* Of them.

The Berbers appear freely to use the singular of nouns, where the sense requires a plural; as *Yiwaθ agθamdint,* una ex urbe, for, una ex urbibus. But the regular plural is in *an:*—

Ergaz, man;	*Wergazan,* men.
Bàba, father;	*Bàban,* fathers.
Os, day;	*Ossan,* days.
Oli, heart;	*Olawan,* hearts.
Ayyor, month;	*Ayyoran,* months.

Most of the feminine plurals, that we have remarked, end in *in,* dropping their final *θ.* Arabic nouns ordinarily take their Arabic plurals; and probably many Berber nouns have irregular plurals. It will be observed that nouns beginning with a vowel superadd W, almost *ad libitum.* Sometimes also those beginning with a consonant; as *Xam,* or *Waxxam,* a house; and *Iw,* initial, for the dative.

We may now proceed to exhibit that important part of a language, the personal and other pronouns.

πέπαλται δ' αὖτέ μοι κέαρ,
τόνδε κλύουσαν οἶκτον.

also:—Ζεφύρου, ἐν οὐρανῷ
κάλλιστον κελαδευμα.

Indeed, it is well established even in prose writers.

Nakki, I	*Katctci*, thou	*Natta*, he ; *Nattaθ*, she
Enaw, of me	*Enak*, of thee	*Enas*, of him, of her
Inakki, to me	*Ikatctci*, to thee	*Inatta*, to him ; *Inattaθ*, to her
Eδnakki, I, me	*Eδkatctci*, thee, &c.	*Eδnatta*, him, &c.
Γi ? *Ayi*, *Iw*, *Ay*, *i*, } [fragment]	*Ak*, *Ek*, *Ayak*, } [frag.]	*Iθ*, *θ*, *Is*, *s*, *At*, *It*, *t*, *ti*, } [frag.]
Nakni, we	*Konwi*, ye	*Noθni*, they
Ennaγ, of us	*Enwan*, of you	*Ensan*, *Ensant*, [f. ?] of them
Inakni, to us	*Ikonwi*, to you	*Inoθni*, to them
Eδnakni, us, &c.	*Eδkonwi*, you, &c.	*Eδnoθni*, them, &c.
Aγ, *Ayaγ*, *Naγ*,* *Aγni*, } [fr.]	*Kom*, *Kam*, *Wan*, *Am*, *Akkoni*, *Kona*, *Awni*, } [fr.]	*Aθan*, *Iθan*, *Oθni*, Θ*an*, *San*, *Sant*, *Sand*, (f. ?) } [fr.]

The fragments of the pronouns are suffixed, prefixed, and infixed ; which agrees better with Coptic, than with the Shemitic languages. Some verbs take double prefixes or suffixes. Thus :—

Afkiγ-ak-at :	*Eδwinna awan-ti-xadman :*
Dabo tibi id.	Eos-qui vobis id faciunt.

For the most part also, *Ayi*, *Ayaγ*, *Ayak*, *Akkoni*, *Awni*, *Ti*, *Oθni*, are used as prefixes ; others as suffixes or infixes. Also *i* is used after a preposition, *iw* after a substantive. Once only do we seem to find *γi* as a suffix, for My. Other remarks might be made of the same kind.—*N* appears characteristic of plurality, though in *Kam*, *Am*, it has changed into *M*. Sometimes *id* stands for Me after a verb. Is *d* euphonic ?

Naθθa, *Eθ*, Θ*an*, seem to be the more primitive forms, whence are deduced *Natta*, *Es* or *Et*, *San* or *Sant*. In isolated positions we also find *Ayyas* (him), *Ayyasan* (them), *Ayyassi* (me), *Ayyasnaγ* (us), *Ayyasak* (thee). Are these borrowed from Arabic, wherein *Ayyà* is a mere fulchrum for suffix pronouns, as Hebrew אֹתְ ?

Natta sometimes becomes a conjunction, That, Because. We also find demonstratives *Wayyi*, celui-ci, *Winni*, celui-là ; the latter of which is a little difficult of explanation. First, there is *Wayyi*, and adjective, *Ayyi*, following its noun ; f. Θ*ayyi* ; declinable also in cases. Next, there is *Wanni*, or *Winna* ; but adjective, *Anni*, *Inni*, f. Θ*anni*, Θ*inni*. The forms *Woyanni*, *Ayanni*, Θ*ayanni*, Θ*ayyini*, are also found. If we mistake not, all of these demonstratives may be used as of either number.

But *Anni* and its derivatives but seldom express a pure demonstrative. They are interrogative, or relative, or combine relative and its antecedent. Thus *Anwa ? Anni ? Winna ?* mean Who ? What ? What sort ? Whoever,

* *Naγ* also means *Or*, *Else*, *Moreover*.

Whatever. Their construction is often as that of אֲשֶׁר in Hebrew; saying *anwa γores,* quisquis ei, for, cuicunque. But commonest of all is the following use:—

*Woyanni, Ayanni, *Ayàn,* ii qui, ea quæ
Niyyan, eorum qui,—quæ
Iyyàn, iis qui,—quæ
Eδwayanni, Δiyyan, eos qui, ea quæ:

which, as far as we have observed, are restricted to the plural number.

Lastly, the Arabic *Haδak* (that) appears in Berber, under the form *Iδak;* of which sense we have found several clear cases. Yet generally this also has become a relative; *Wiδak, Iδak,* who, which; *Iwiδak,* to him who, to those who; &c. The element *Iδa* enters various Berber relatives; as *Eniδa,* where (*οὗ, ποῦ*); *Maδa* (*ὅτε ὅτι*); &c. *Oyawmi* also appears as a relative, seemingly in the genitive, as *cujus.*

After seeing the forms taken by nouns and pronouns, the reader may have satisfaction in inspecting the following specimens of simple logical propositions.—

i. 15. *Natta aδyili δa-maqràn azzaθ o-maqràn.*
He shall be mighty before the mighty one.

i. 19. *Eδnakki ayeδ-Djibrìli, ibaddan azzaθ Rabbi.*
As for me, I (am) Gabriel, standing before God.

iii. 15. *Wissan aδil eδ-natta ayδ-el-Mesìχ.*
Whether were he the Messiah.

iv. 3. *Maδay-θallit δ-ammis ar-Rabbi.*
If thou be son of God.

iv. 22. *Orilli eδ-wayyi ayδ-ammis ay-Yùsofa?*
Is not this (the) son of Joseph?

The double *eδ* in these cases is worthy of notice.

The tenses of the verbs must next engage us: and first the verb *to Be.*—

Illa, erat is	*Aδyili, Attili,* erit, sit, esset
Θ*alla,* erat ea	*Attilit,* eris
Θ*allit,* eras	*Aδiliγ,* ero
Alliγ, sum	*Aδilin,* erunt
Illan, erant	*Attallam,* eritis
Θ*allam,* eratis	*Annalla,* erimus.
Nalla, eramus.	

* Written also *Ayyàn,* and *Alyàn,* the latter with a mark by l, to assimilate its sound to y. We suspect *Allan* is sometimes for *Ayyan;* and hence our embarrassment about that word. The modern Arabs say, *Elly* "which;" of which the Berber plural would be *Eliyàn.*

For *Adyili,* we saw above the syncopated form *aδil* (in a subjunctive sense); but Luke i. 45, we read *aδinnakmàl* (there shall be a completion), for *aδil nakmàl.*

Attili might seem to be feminine, yet it is used as masculine. Perhaps two forms, *Aδyili* and *Aδθili,* have merged in one; which is the process whereby distinctions of gender vanish, in course of time.

For the initial I, (as in *Illa,*) we sometimes find Y; and the prefix is no doubt from Arabic. In the Showiah language, which is akin to the Berber, *Illa* is *reported* for "It was," and *Alla* for "It is." Perhaps *Alla, Allan,* are contracted from *Aδyili, Adyilin*: for we find *Oralla,* "it will not be." Yet what *Allan, Allant,* means, we cannot ascertain,

That *ant, int, unt,* appear as terminations of the third person plural, was stated in our third number, as a coincidence with the Indo-European and Celtic languages. If is certainly striking, if it be accidental. But be it observed, *ant* sometimes is deceptive, the *t* being a pronoun suffix; as, *ταfran-t* (they followed him); *asaqran-t* (they called him). Sometimes, again, *ant* is the feminine of an adjective ending in *an;* as, from *Amaqran* (many, great), *Kamil* (long), we have:—

Madda θamaqrant;	*Madda θakamlant;*
time(s) many;	time long;

forms analogous to *Θamdint, Θaqcicθ,* &c. Moreover, if we mistake not, this feminine singular of the adjective forms concord with nouns plural, if it cannot claim to be considered as an actual feminine plural. But, after removing all such cases, there remain numerous clear and unequivocal instances of *nt* and *nd,* as the mere third person plural. *Arrand laxbar* (they took information), *Olint* (they went up), *Osand* (they came), *Aqland* (they returned). These indeed, and others, show a tendency to take a final *d,* as if *εφελκυστικὸν.* For we have *θolid* (she went up), *Yosad* (he came), &c. But this is not always the case, with verbs which give the termination *ant.*

Akrant ibγant akk-azrant; viii. 20.
Stant, volunt te videant.

Here are three verbs, not one of which we have met with *d* final. Yet this *d* we are obliged to leave unexplained; as we find cases such as, *Ibàn-as-ad el-malk,* "Appeared to him the angel." *Ibàn* and *Malk* are Arabic; *as* the Berber suffix.

It may be well to exhibit the same two tenses in *osa,* to shew the *d* final.

3. *Yosad,* he came	3. *Aδyas,* he may &c. come
θosad, she came	he comes
2. *θositad*	2. *Attasat*
1. *Osiγad*	1. *Addosiγ*

3. *Osand*	3. *Aδyosan*
2. θ*osamd?**	*Addasan*
1. *Nosad?*	In Imp.—*Osθad,* bring ye.

In *Alla* there seems but one radical, L; in *Osa, Oli, Eni* (or *Weni),* one or two seem to be defective only occasionally, as in the Shemitic roots, Triliteral roots, however, are frequent in Berber, and all Arabic roots are readily conjugated by Berber rules; even those which belong to the derived forms in Arabic. The *Ist* of the Xth form becomes *Isθ* in Berber.

Example of a triradical: (from Arabic, *Xadam,* coluit, serviit.)

3. *Ixδam,* he did	3. *Aδixδam,* he may &c. do
θ*axδam,* she did	he does
2. θ*axδamaτ*	2. *Aθxaδmaτ*†
1. *Xaδmaγ*	1. *Aθxaδmaγ*
3. *Xaδman*	3. *Aθxaδman*
2. θ*axδamam*	2. *Aθxaδmam*
1. *Naxδam*	1. *Annaxδam*

In the accusative, the δ absolutely never changes into *d,* θ, or *t;* but in the present tense *Aδ* is perpetually suffering euphonic changes into *Aθ, Add, Att, At;* and often presents forms so like the Vth of the Arabs, (Hebrew *Hithpahhel,*) as to suggest that it is copied thence.

Another tense is formed, of stronger futurity, indeed equivalent to the English, (I *must* do,) or, (I *am* to do,) by prefixing *Ara* to the verb. They likewise produce the same tense, by combining *he was,* &c. with the future of the verb; as though in Latin *erat veniet* were used for *erat venturus.* This also is Arabic Idiom. As an illustration of both methods, we have:

vii. 19. *Eδkatctci ar-adyosan?*
(An) tu (qui) debet venire?
vii. 20. *Eδ-katctci wenna illa aδyos?*
(An) tu is-qui erat veniet?

Thus we form;—*Arayili,* he must be; *Arayilin,* they must be.
Arattili, she must be; &c. &c.

But if the verb be transitive, and govern a pronoun, this intervenes to separate *ara* from the verb: as;

Ara-k-hadr-aγ, I must thee tell:
Ara-kona-xabr-aγ, I must you inform.

The negative particle is the prefix *Or;* which is likewise separable by pronouns from the verb.

* At least, θ*argamd* (ye came out), from *Irag;* a verb in which *d* is not generally found.

† We know not what to make of viii. 5; *Issofaγ el-zarriꞒa attakarzar iwrik:*—"Went out the sower that *thou* mayest sow *thy* seed."? Hardly! *Araw,* not *Iwra,* is elsewhere Seed. *Attakarzar* is most probably a noun of action, final *r* for θ.

Or-alla, he will not be
Or-oggaδ, ne timeas (Zacharia!)
Or-attaggaδaθ, ne timeatis
Or-attila, she will not be (?)
Or-attaggaδ, ne timeas (Simon! Mariam!)

This negative often takes a sort of complement, following the verb, (as the French *ne——pas,*) in the particle *ara.* Thus the length of words continues to increase, and the syllables need modification with it.

Or-addusiγ-ara,
Non venio omnino.
Or-ay-θatχufm-ara
Ne me quæratis omnino.
Or-aƐlimn-ara,
Non noverant omnino.
Or-aγn-atχibb-ara,
Non nos amet omnino.

The Imperative Mood forms a plural by adding *θ,* or sometimes *t;* which plural seems applicable to all three persons, by adding the pronoun.

Iliθ, be ye!
Roχ, go thou! *Roχaθ,* go ye!
Roχaθ ayyasnaγ, go we!
Axδam, do thou! *Xaδmaθ,* do ye!

A participle or verbal adjective is formed in *an* f. *ant:* as *baddan,* ἑστηκὼς; *baddant,* ἑστηκυῖα; from *Ibad,* he stood. A sort of future participle is produced by prefixing *ara;* as *ara-koni-σabran,* debens-vos-baptizare; from *σabber,* be sponsor, baptize. Sometimes again *ant* is found, where we expect a masculine singular: and altogether we suspect the sounds of the language are unsettled, as to final *an, ant, ad.*

Another participle imitates Arabic, in prefixing *M;* as from *AmnaƐ,* to save; *MimanƐan,* saving, salvatory.

Ordinarily the language evades the *passive* by a periphrasis; as, "They have sent me," or, "One has sent me," instead of "I am sent." The verbs have likewise exceeding liberty of being either active or neuter. Yet the preposition *As* (in), prefixed to a root, frequently makes it transitive. Roots are also compounded with the preposition, *Az* (at). Possibly they are but variations of the same word.

From *δokkal* (to gather) is formed *AsδokkaI,* or *AzδokkaI* (gather in): so we find *Izzaδmar,* he answered, *Θazzaδmar,* she answered; where *Az* intervenes between the root and the pronominal prefix. Instances of *as* are more common than of *az,* in composition. The prefix *im* or *mi,* if it be not indicative of a new tense, appears like a preposition in composition.

Verbal Substantives:—

Hδr *Nihdar,* speech.
Kml *Nakmàl,* completion.

Perhaps with these may be classed those formed by initial *L,* as;—*Lahδir,* word, speech; *Lafkàk,* deliverance, ending; *Laktàb,* a book; *Lax-*

bar, information; *Lamna*, faith; *Labna*, building. In these, *L* sometimes looks like the Arabic article.

Zr	*Θimazriwθ*, vision, sight.
Sl	*Eθmasliwθ*, report, hearing.
Zl	*Θimazliwθ*, sacrifice, offering.
	Atzillaθ, praying.
Δor	*Θaddùrθ*, *Ettamaδorθ*, living, sustenance.
Δgl	*Ettaδgalt*, widow.
Γly	*Θiγalyawθ*, falling.
Zmr	*Ettazmarθ*. power.
Fos	*Θayyafosθ*, right hand.

The fondness for an initial θ, with feminine nouns, is such as to lead them thus to remodel many Arabic nouns. As, *Θamdint*, city, for *Medìnet*; *Θoddar*, village, country; from *Dàr*; and see *Θaddùrt*, above. The θ also becomes τ; as from *γawwa* (strength), *aτγawwa*, by the influence of γ.

Verbal substantives, formed by initial *M*, are of course introduced from Arabic; but there are various instances of the same thing in Berber roots; as, *Ilol* (to be born), *Milol* (birth); *Izwir*, (to proceed), *Mazwar*, (process); *Iksa* (to graze as swine), *Maksaw* (a shepherd).

Arabic is manifestly the basis of religious vocabulary to the Berbers, as the following list of words will show.—

God, Jesus Christ, Lord or Sir, Spirit, Virgin, Angel, Devil, Demons, Paradise, Kingdom, Tenet, Minister, Thank, Love, Joy, Rejoice, Bless, Praise, Glorify, Glory, Believe, Salute, Bow the head, Circumcise, Baptize, Preach, Priest, Prophet, Temple or Synagogue, Mystery, Parable, Comparison, Passover, Feast, Custom, Peace, Blessed, Reward, Request, Repentance, Forgive, Grace, Mercy, Law, Soul, Life, Death, Just, Useful, Be lawful, Wisdom, Knowledge, Witness, Virtuous, Holy, Master or Teacher, Leprosy, Cleansing.

The following also have been remarked as Arabic:—Power (four different words), Magistrate, Deputy or Steward, Information, Stature, Writing or Book, Tablet, Perform, Anoint, Help, Pass by, Work, Smooth, Build, Turn, Live, Die, Dead man, Go, Begin, End, Oppress, Destroy, Harm, Approach, Increase, Fear, Be fitting, Speed, Darkness, Dew, Dawn, Strong, Completion, Cry aloud; Arrive; Father, Mother, Babe, Name, Parents, Neighbours, Flocks, Herdsmen, Sea, the Deep, Ship, Desart, Outside, City, Region, Earth, Raiment, Butter, Oil, Wine, Roof, Bedstead, Stone, Fruit, Space, Time, New, Good (subst.), More, Midst, Root, &c.

It will be expected, that in some cases the sense of the Arabic word is partially modified; yet it is in all these very easy to trace.

In some cases the deviation from the Arabic is worthy of remark:

Qara in Berber means, to call aloud; to call or speak; to call by a

name or give a name; to recite or read aloud; to read; to give a lecture or preach. All these senses are found united in Hebrew, though not in Arabic.

Iqdac, ἐλειτούργησε, *he ministered*, (in holy things,) has the Hebrew קדש Yet *Qaddùs* (holy) is found also with the Arabic *s*.

Caγàl (work), seems to have become ecclesiastical; "the *course* of Abia," "the order of his *course*."

Cukr (thanks), has produced in Berber, *Ickar*, he pronounced a blessing ....on God or man; ἐμακάρισεν; and *Cakra*, δόξα, glory, splendour.

El djannaθ, bliss! as Elizabeth to Mary, "Paradise [i. e. blessing] be to her who believed." This is one out of many cases, where the Berbers agree with the Hebrews in preferring *θ* final to *t* final, as a feminine termination.

Xadam (he served), becomes *Ixδam*, which sometimes means (he worked), but ordinarily (he did).—Just so in modern Greek ἔκαμε, he did, he made.

ξali, in Arabic, High, Tall, Noble, Glorious; in Berber is the familiar term for *Good*, in every sense. The frequent prefixing of the Arabic article to *ξali* by the Berbers, appears a presumption that the word came to them from the Arabs:—if indeed *elξali* be not the true word.

Baγa or *Baγi* in Arabic has *Petiit, Quæsivit*, as one meaning; in the seventh form, *Convenit, Decuit*. In Berber, it is the common word for *Voluit;* with the senses of Propriety, Suitability, Desert, often combined. If we mistake not, it also forms a future past tense, as English *would*.

Σafi, clear, pellucid. In Berber, *Iσfa*, he was clean (of leprosy); *Σaffi*, he cleansed (another).

Zìd, follows in Berber the Hebrew sense of Sin; seldom the Arabic of Surplus, Excess.

Baptize is expressed by the Arabic *ξammed* (confirm); a word thus distorted by the Arabs themselves; by *σabbir*, also to confirm, or to become sponsor, and in Berber, to console; but besides, we find for the same *Iδham* (rained, beat, vi. 49), *Itkal*, *EΞkaz*, and the substantives, *Aswasγar*, *Assabγa:* (qu. dip? sprinkle? wash?)

Karrez is the Arabic word generally employed by the Berber translator for Preach; but elsewhere he uses it for *To sow;* which in the parable of the sower sounds odd.

But to carry on any available criticism on such details, an acquaintance with the Arabic of Barbary is requisite. It would be curious to learn, whether the tendency to use *δ*, *θ*, for *d*, *t*, and contrariwise to reject *δδ*, *θθ*, for *dd*, *tt*, in which the Berbers and Hebrews appear to agree, as contrasted with the Arabs, is likewise prevalent among the Moors.

But to show that the original material of the language is not Arabic, we shall now give as ample a vocabulary as our limits permit; for the most part omitting words that are obviously Arabic.

PREPOSITIONS.

Ga, Ag, from, than.
Sa, As, in.
Eδ, δa, with. / Δ*iδ* (before suf.)
An, Na, of, than.
Az, at.
Gar, between, among.
Γ*ar*, for. / Γ*or* (with suf.)
Aγra, into ; [Verb, *Azzoγra*, bring-in.]
Δ*ag, Aδga*, concerning, from, from among.
Γ*af, Aγfa*, at, over.
Addaw, under.
Δ*affir*, behind, around, [subs. time, period.]
Asγor, from, by.
Azzaθ, in presence of, against.
Azzag, out, after, [Verb, *Azag*, go out.]
Amma, according to, like.
Agθama, from or at the side of, on the part of.
Falla, upon, against, beyond.

ADVERBS, CONJUNCTIONS, &c.

Δ*aγanni*, also.
Naγ, or, else, moreover.
MaΣna, no! nay but, but, [subs. a parable, Ar.]
Wissan, whether, lest.
Amak, Ensi, how?
Ensiθ, whence?
Eniδa, Enidallan, where / where?
Eδag, whereupon, when.
Amammi, why?
Ammin, as.
Imir, Aggimir, instantly.
Acu, Acoθ, what? (from Arab.)
Acaγaf, why?
Ala, Olac, Aloc, and not, (Ar.)
Molac, else, if not.
Lu kan, were it that, (Ar.)
Mayal, because. / *Maδayalla*, that.
Maδay, Ma, if.
Alamayal, Ala, save only.
Aγfassabba, because.
Alamma, until (Ar.?)
Natta, that. / *Noθni*, (?) because.
Aθaya, here is!
Δ*ayyini*, here.
Θ*ora*, now (Romaic, τώρα).
Ofalla, Asofal, on high.
Xiralla, many.
Akra, Akrayallan, all.
Nazzah, very, greatly.
Akkayyi, thus.
Akkanni, as.
Amya, a hundred (Ar.) many, greatly,
Acwayyi, a little (Ar.)
Ilkal, all (Ar.)
Acamma, [not] any thing.
Aσal, much rather.
Aywaq, when (corrupt Ar.)
Ag qaddàc, how much more (corrupt Ar.)

Of the numerals, the first is *Yiwan*, one; f. *Yiwaθ*. Next *Sin*, two; f. *EsnaΣ*, also *Esnin*, both; are from Arabic Θ*in*, Θ*inìn*. The rest are pure Arabic, as far as we have met them.

SUBSTANTIVES, ADJECTIVES, &c.

Bàba, father, Lord.
Yamma, mother.
Ergaz, man.
Maddan, men.
Θ*amaττoθ*, woman.
Xalaθ, women.
Ammis, Mamma, son.
Aqcic, boy.
Yalli, daughter.
Θ*aqcicθ*, girl.
Agma, brother.
Waltama, sister.
Θ*awala*, mother in law.
Kanna, daughter in law.

Aσfa, kinsfolk.
Araw, seed.
Arac, children.
Elγaci, *γaci?* } people.
Θ*isagwa*, people.
Emγar, *Emqràn*, } nation, multitude.
Basaτ, tribe.
Θ*amdint*, city, region (Ar.)
Θ*oddar*, Pl. *Attoδrin*, } country (Ar.)
Aδrar, hill.
Makàn en-*toja*, a plain.
Θ*amorθ*, neighbourhood.
Aχli, *Laχla*, desart.
Abriδ, way. *Baχr*, sea (Ar.)
Θ*obriθ*, Θ*abχiriθ*, Θ*abχarθ*, } lake, from the preceding.
Rif, shore, brink.
Θ*asaττa*, fruit.
Eθsaτaw, tree.
Θ*ofamt*, reed.
Man, *Iman*, } soul, self.
(*Ayyimanis*, by himself.)
(*Imanan-san*, by themselves.)
Djatta, body.
Aqarroy, head.
Ofos, hand.
(*Ofos ayafùs*, right hand.)
(Θ*ayyafosθ*, ditto.)
(*Ayafùs*, south.)
Oτad, finger.
Γ*al*, arm.
(*Iγil*, cubit.)
Aτar, foot.
Aθgacrar, knees.
Oδam, face.
Wanzid, hair.
Θ*iτ*, eye.
Miττaw, tear.
Mazzoγ, ear.
Qamoc, mouth.
Yim, mouth?
Yilas, tongue.
χ*ank*, cheek (Ar.)
Dam, blood (Ar.)
Aδmar, bosom?
Oli, heart.
Ɛ*abboτ*, womb.
Θ*ama*, side, part.
(*Artama*, without limit?)
τ*ibƐa*, loins.
Enσàf, midst, waist (Ar.)
Ic, horn?
OqaττaƐ, herd.
Γ*ayola*, beast for riding.
Yelfa, pig.
Zamar, lamb.
Azram, serpent.
Occan, wolf.
Θ*iγizdamt*, scorpion.
Igθarfa, ravens?
Yagτaτ, birds.
IzagƐabàr, sparrows?
Θ*amallen*, egg.
NaƐma, food.
Aγrom, bread.
Makli, meat.
Aslam, a fish.
Yaχbàl, loaves.
χ*abb*, fruit (Ar. grain).
Θ*og*, *Attog*, grass, herbs.
Alim, chaff.
Irδan, corn.
Caràb, wine (Ar.) leaven.
Agla, goods, property.
Aδrim, treasure.
Elfatta, money?
Atwazri, cloak.
Alamdil, coat.
Affar, shoes.
Δ*affir*, period, time.
Azak, to-morrow.
Azgan, place? oath? exclamation?
Aryàf, south.
Saggas, year.
Ayor, month.
LaƐwam, season?
Os, *As*, day.
Assayyi, to-day.
Iτ, night.
Azgon ayyiτ, at midnight.
Θ*iramt*, hour, instant.
Imir, instant?
Tcawwam, heat, [*Cawwab?*]
Θ*amagra*, harvest.
Lahwa, rain, storm (Ar. wind.)
Aτo, wind.
Signa, cloud.
Θ*agnaw*, heaven,
Θ*imas*, fire, hell, [Hades!]
Θ*afokθ*, fire, [once only.]
Θ*afaθ*, light, [once, *oven:* rather, flame?]
Wamàm, *Wamàn*, } water.
Wasif, stream, flood.
Worar, abyss.
QaƐ, earth, soil (Ar.)

Qari, earth, world.
Okal, dust.
Caffa, a steep place.
Kal, Kakal, rock.
Azrar, rock ?
Azar, root.
τayyàc, seed.
Sannan, thorn (Ar. ?)
Nidjil, bramble.
θazarθ, figs, } vi.
θizorin, grapes, } 44.
(*θizorin* looks like the plural of *θazarθ* !)
Zarj, skin bottles.
τarràχ, aτraraχ, nets.
Mahraz, measure, a measure.
Xam, Waxxam, house, temple.
Yaδni, roof.
Jarraf, }
Tcarraf, } foundation.
θogota, }
Zakwa, tomb.
θawworθ, gate, door.
Mandjar, seat, throne (from Ar. root).
Alloχ, bedding.
θaγric, bier.
Amdon, ditch.
manger.
Djabs, prison.
Immi, servant (Ar. ?)
Wakli, Wakil, Akli, servant (Ar. *Wakìl*, deputy, steward).
θakli, female servant.
WarbaƐ, soldier.
(*θarbaƐθ*, discipline, disciples, citizens, people.
Amdar, fool.
Maksaw, shepherd (from *Iksa*, to graze).
Oraqqas, messenger, apostle.
Gazan, priest ?
Ɛazri, attendant.
Yasli, bridegroom.
θisliθ, spouse.
Amaqràn, great, numerous.
Lord, authority.
Kamil, long, tall.
ElƐali, good.
Foxàn, Ifox, wicked.
(*Naffax*, misery ?
Elham, } evil, mis-
Δiri, Diri, } chief.
Xayr, Xir, good } (Ar.)
Axir, better }
Erγàl, blind.
Ɛazzog, deaf.
Ɛaggon, dumb.
Iqqoran, withered.
Mazyàn, least, little ?
Naggar, last.
(*Tangar*, end ?
(*Attannagarθ*, last state.
(*Arattangar*, without end ?
Atwàb, merit.
Lomayra, sign.
Bakri, beginning (Ar. morning).
Ɛaθya, peace ?
OƐayyar, temptation.
θojχa, } wrath ?
Itctcam, }
Laχaqθ, judgment (Ar.)
Amakθi, thought.
LaƐfo, repose (Ar. ?)
Waswa, burden.
Ladjhal, fury, madness (Ar. root).
Coh, reproach.
XocoƐ, abasement.
θawla, fever.
τaq, candlestick.
Maσbàχ, candle (Ar.)
Aσbàχ, to-morrow (Ar.)
Iσbaχ, some, several.
(*Eδσabaχan*, nearly about.
(*Iσbaχ*, it fell by chance.
Aδros, few ?
Wayaτ, Yaτ, other ; pl. *aτnin*.
Aggaygarasan, to one another.
Mazlaτ, poor.

VERBAL ROOTS.

(We have tried always to exhibit the third per. sing. of the preterite.)

Yosa, Yosad, come, bring, bear (a son).
Yoli, Yolid, go up, bring up.
(*Isol*, lead up, visit.
Irra, take.
(*Arrand laxbar*, they took knowledge, perceived.
Yoγa, take, catch, take away, put, receive, transmit ?
Illa, be.

Ini, Inià, (Wenniàs) } say.
(*Iseni*, say ?
Isna, know.
(*Isisonna*, make known ?
Yofa, find.
Yawi, answer.
Ιττα, hurt.
(*Αττα?* disease, infirmity.
Yοταn, be sick, infirm (with age).
(*Αττan ?* disease.
(*Μοταn*, sick.
(*Awταn aδimoθ*, ready to die.
Ifka, give, pay.
Irτal, lend (Ar. weigh).
IsƐa, get, possess.
Iswi, forfeit ?
Inγa, lose, destroy.
(*Neγατ*, destruction.)
Iγra, ask for, invite, summon.
(*Aγra*, into.
(*Izzoγra*, lead, bring to.
Igra, let down, put forth, shed (blood), scatter (seed).
Imgar, toss, pour in.
(*Imyagra ?* send in.
(Θ*amagra*, harvest.
Mγr, or *Mqr* implies greatness or number.
(*Emγàr*, *Amaqràn*, a multitude, old.
(*Amaqràn*, Lord, great, power.
(Θ*amγar*, old age.
(Θ*amaγra*, a wedding. qu. festival ? great doings ?
Imog, put, lay, set, lie.
Imγi, spring up (as grass).
Iγla, fall.
Iγza, dig.
Irza, break, bruise.
Issaγras, break.
Igzam, cut, cut off, behead, cut down, rend.
Ibτa, divide, scatter.
(*Abτoθ*, division.
Ibra, cover ?
Ibro, send away, send, cast forth.
(*Innabra*, bring away.
(*Sinabra*, dismissed, at liberty ? iv. 19.
Ilda, open.
Iδal, cover ?
Yonza, fall down, decline.
Isaraδ, *Israd*, wash.
Irsa, cast, set down.
(*Irsad*, he fell upon.
(*Isarsi*, threw upon.
(*Isrcs*, laid [hands] upon.
(*Iras*, } is set down,
(*Isras*, } written.
(*Isorsad*, was revealed.
Ilsi, touch.
Ilsa, wear (clothes).
Itlos, put on (clothes).
Irno, add.
Irba, } rebuke
Itrab, } (Heb. ?)
Igma, forbid.
Isla, hear, obey.
Izra, see, seem, show.
Izla, pray (to God).
Iqqa, } bind.
Iqqan ? }
Iqqil, } turn, return.
Iqla, }
Irwa, be full.
(*Isarwa*, fill.
Itc, stretch out, reject.
Itctca, be healed.
(*Isotctci*, heal.
Itctca, *Idjdja*, leave, forsake, omit, forgive, yield (fruit).
Itctca, *Ijja*, eat.
(*Isatctca*, feed.
Itctcor, be full.
Illoz, be hungry.
(*Laz*, famine.
Θ*atta*, eat.
Θ*assa*, drink.
Iksa, graze, feed.
(*Maksaw*, shepherd.
Ibad, stand.
(*Isbad*, cause to stand.
Igan, lie, be asleep.
Iqqim, sit, abide, dwell. be lame.
Ikkar, stand up, rise up, awake.
(*Iskar*, cause to stand up, cause to be. set, place, build, make. neut. become.
Iqqor, wither.
Iqra, *Iqqar*, } (Heb.)
Isaqra, } call, call out, recite, read, give a lecture, bestow a name.
Ifθi, form a judgment.
(*Mafθi*, judge : MUFTI.
Imakθi, pl. *Makθind*, think, reason, consider.

Isborr, consider (Ar. wait, stop !)
Iggol, swear ?
Iðor, } *versari:* turn
Iðra, } about, dwell, live.
Idir, turn (act) ; each is Arabic.
Iтar, go down.
(*Aтar*, foot.
(*Isaтar*, cause to go down.
Ifoγ, go out, away.
(*Isofaγ*, thrust out.
Idjoz, go out, strip off.
Izag, go out.
(*Azzag*, prep. out of.
Irag, *Iraj*, come out.
Icaγ, go forth (as news).
Isawal, tell, tell abroad, preach good tidings, iv. 18, give leave, allow. From *Awal*, *Wal*, *Wawall*, a rumour, message, affair, or matter.
Isayyal, judge.
(*Issosayal*, demand, Ar. ?
Issag, look, look for, look at.
(*Ossig*, aspect.
Isoθar, entreat, seek, ask back.
Iχof, seek after.
Isaqsa, interrogate, tempt.
Iχza, curse ?
Isaho, be forgotten ?
Iγàb, journey.
Irawl, flee from.
Iтùl, prolong (Ar.)
(*тolan*, a delaying, a while.
Iγocc, hate.
Izho, rejoice.
Iтro, weep.
Ihoz, quiver, rend.
(*Ithozzo*, be troubled.
Ittatta, laugh.
Yoθan, blaspheme.
Yoggaδ, fear.
Iθaddo, walk, go.
Roχ (Ar.), go.
(*Isarwaχ*, cause to go.
Iттal, wrap up.
Imтal, bury.
Iтfa, take in, let in, keep, hold, reach at ?
Iттaf, smite, attack, accuse.
Inbaт, accuse ?
Innabah, command, rebuke.
Izδam, undertake ?
Izδar, sink ?
Izzad, be at ease. }
Izaδ, deny himself ! }
Asad, let (me) !
Izδaw, lay (his head), recline (at meals).
Iσδa, } to fish (Ar.
Isтaδ, } *σayd*, la chace.)
Izom, fast (Ar. *σòm*).
Iθὶθ, beat.
Ibδa begin (Ar.)
Ifokk, finish, leave off, deliver (Ar.)
Iɛas, live (Ar. *ɛàc*).
Imoθ, die (Ar.)
Ilùl, give birth.
(*Milol*, birth.
Iraw, bear seed.
(*Araw*, seed.
Ixlaq, grow.
(*Isaxlaq*, conceive children.
Izmar, be strong, be able, avail.
(*Agzamran*, powerful. Compare the Indian word, *Zamorin*, ruler.
Isnaz, sell.
Itnoz, be sold.
Iznaz, spend, expend.
Ikraz, sow.
Ingaz, reap.
Iтχaθ, be sound in health.
Iσhal, be restored, healed.
Iσlaχ, be ameliorated, gain advantage (Ar.)
Iχmaz, gird (Ar. *Iχzam*).
Icod, bind up (wounds).
Itbar, pour in (oil and wine).
Ixrab, be changed, altered (Ar. ?)
Itlaɛ, to talk.
Irdam, } rained, beat,
Idham, } &c.
Iswaγ, choke ?
Isaraγ, be kindled.
Isoδan, receive, welcome, kiss, take up (in discourse).
Isafтin, wipe.
Isosam, stop (another's) mouth, remain dumb, be calm, deny ?
(Ar. *σamat*, hold one's peace.)
Isanqal, cause to totter.
Isabzag, wash.
(*Assabγa*, baptism.
Itrocco, wash (with tears), sprinkle ?
Isalmaδ, be anxious ?

Icokkaθ, doubt about, care about.
Imhal, hope for (Ar. ?)
Iwhom, marvel.
Inzah, rejoice exceedingly.
(*Nazzah*, adv. vehemently.
Irfab, expect.
Itradj, wait for.
Isabbaχ, offer vows and prayers.
(*Sosabbaχ*, in congratulation.
[Arabic salutation: *Mìt σobaχ σobbaχak.* "Centum dilucula te matutinent!"]
IƐabbir, measure out.
Itzakki, tithe?
Iχsab, prepare.
Ihδar, speak.
Iγmaz, make signs.
Iskon, point out, show, teach, do violence (!)
Isakna, be witness of? see? learn?
Izzaδmar, reply.
Ibarreχ, cry aloud.
Izaggir, prepare oneself.
IfγaƐ, be grieved.
Iqraτ, hate?
InnaƐ, defend, deliver (Ar. hinder).
Iγral, shut? throw down? break?
Innaγral, be drunken, hasten.
(*Γarlan*, intoxicating.
Ikcam, enter.
Izwir, proceed.
(*Θazwara*, first.
(*Mazwar*, process, order. Preferable.
(*Imazwora*, ancient.
Idwam, serve?
Irfaδ, lift up, help, carry off, remove, or drive away. Remove oneself. Conceive a child: *συλλαβεῖν*.
[It seems to unite Arabic *Rafad* and *RafaƐ*.]
Iτayyar, take away.
Iτaxxar, thrust off from land.
Iτγar, lie, bring, come.
(*Isaτγar*, offer up in sacrifice.
IcayyaƐ, send, send away.
Iffar, be hidden.
Iτfar, follow, persecute, vex, annoy.
IτaƐτaƐ, murmur.
Imakni, dash against.
Ixibτo, burst.
Inaqca, preach?
Inaqsa, sin?
Inwaddar, be trodden down.
Iδokkal, assemble.
(*Izδokkalⱽ*, (*Isδokkalⱽ* } assemble.
(*Imdokkal*, (*Amdaklo*, } comrade, partner.
Iwraz, be confined, captive?
Irza, receive, approve.
(*Arza*, approval, complacency.
[This word is evidently Arabic, and we remark it as the only word in which Arabic *Zza* or *Dda* appears. The Syrians pronounce *Ràzi* (contented), as if with English *z*.]

The similarity of the words *Θawala*, mother-in-law, and *Θawla*, fever, has surprised us greatly; but on comparing iv. 38, 39, and xii. 53, the fact appears beyond doubt: nor can the text be any how accounted for by error of the press; nor by any error of the translator, except such as would prove him an idiot. In iv. 38, he has avoided saying that the *θawala* of Simon was sick of a *θawla*; using *laχdjayyi* (necessaria?) in that passage for "mother-in-law." We believe that in Berber, *θawala* and *θawla* are undistinguishable. Interest is given to the point, by the fact that in Arabic, *χamà* [so pronounced] is a mother-in-law, and *χomma*, a fever; and in this very passage, the only Arabic translation to which we have access (that of Sabat), states that the *χamà* of Simon was sick of a *χomma*. Now that this odd coincidence of the two languages can be accidental,

seems beyond probability; yet if otherwise, one of the two has acted upon the other in a mode to which we remember no parallel.

We are far from thinking that in the above list, no words can be traced to the Arabic, except those which we have noted as such. Our own acquaintance with that very extensive language is but superficial; and where a word occurs but once or twice in the Berber translation, or shows none of the same family, we cannot always ascertain its real and primitive sense. Most of the words to which we have put the mark (?), are ἅπαξ λεγόμενα.

Yet after the most ample allowance on this head, our vocabulary seems to contain abundant proof, that the original material of the Berber language is not Shemitic. Whether those who are acquainted extensively with the relations of languages, will be able to identify it with any known family, remains to be seen. At present, we shall make use of this language to verify the assertion in our third number, that the strongest similarities in the inflexion of verbs and nouns may exist between two languages perfectly distinct; that is, as distinct as any other two on the face of the earth. We do not wish to involve the question, whether at the confusion of tongues all or many languages retained some parts in common. We would not be tedious in recapitulating the similarities of the Berber inflexions to those of Arabic, and perhaps the shortest and most striking method to those unacquainted with the Shemitic languages, is to lay before them the following table.

ARABIC FORMS. (Modern.)

Sing.		Plur.	
3.	*Ixdom*	3.	*Ixdomùn*
	f. *Taxdom*		
2.	*Taxdom, Xadamt*	2.	*Taxdomùn, Xadamtom*
1.	*Exdom*	1.	*Naxdom.*

The termination *ùn* in Arabic indicates plurality in nouns and verbs alike. The *n* is very commonly elided in the verb, just as final *tom* becomes *tù*.

BERBER FORMS.

Sing.		Plur.	
3.	*Ixdam*	3.	*Xadman*
	f. *Θaxdam*		
2.	*Θaxdamaτ*	2.	*Θaxdamam*
1.	*Xadmaγ*	1.	*Naxdam.*

It would seem as if the second person of each number, in Berber, had been made up at each end out of two distinct Arabic tenses. The only person in which there is no similarity, is the first pers. sing.; and it is worthy of remark, that also in the Maltese Arabic this has been changed.

Perhaps *Exdom* was found too similar in sound to *Yaxdom*, when this last had been vulgarized into *Ixdom*: and the imperative is also nearly the same. Hence the Maltese say *Naxdom*, for the first pers. sing. and in the plural, *Ixdomù*, *Taxdomù*, *Naxdomù*. Equally by the form *Θaxdamaτ*, the Berbers avoid the awkward ambiguity of Arabic, in which "she does" and "thou dost" are the very same word.

But besides these similarities of verbal inflection, we have the pronouns:

	I, &c.	We, &c.	Thou, &c.	Ye.
Berber	*Nakki, aw, iw, i*	*Nakni* *Naγ*	*Ak*	*Kon*
Shemitic	*Anoki, ni, i*	*Enaxnu* *Nu, Na*	*Ak, Ka*	*Kom, Kon*

Some might think it paradoxical to maintain, that the two families of languages drew from a common source; and that the Berbers have retained the older forms. Yet *à priori* this is not at all incredible; and in some of the forms there is the appearance of it. *Nakki*, pl. *Nakni*; compared with *Natta* (for primitive *Naθθa*), pl. *Noθni*, appears regular; but *Anoki*, pl. *Enaxnu*, is less so, and has no Hebrew parallel. *Ani* (Hebrew), and *Ana* (Arabic), appear corruptions of *Anoki*. *Naγ* may seem older than *Na*. On comparing the Coptic pronouns *Anoki* (I), *Anon* (We), with suffixes *i* and *n*; and in the second person, suffixes and verbal inflexions, *K* (in sing.), *Ten* (in plural); our prevailing conviction is, that various African languages must originally have had some of these points in common with the Shemitic.

Moreover, in Berber and in the Shemitic tongues, *an* and *in* (*ùn*) are plural terminations; which seem common to nouns and verbs; just as in Turkish they form Adam (a man), Adam*lar* (men); and Baqdi (he looked), Baqdi*lar* (they looked). In some dialects of Celtic, *in* forms a plural; nay, and many German and Anglo-Saxon plurals are thus formed. These coincidences weaken our argument, by inspiring a suspicion that *n* is so easy of utterance, that it is not too much to suppose the coincidences accidental. The same suspicion recurs, when we find adjectives formed by adding *an* in Berber and in Arabic, and in Latin (-anus), &c.

It remains to add; that verbals are formed by prefixing *m*, alike in Coptic, Arabic, and Berber; while in the same three languages, *t* or θ indicates a feminine, sometimes prefixed, sometimes suffixed, in nouns and in verbs.

In Coptic it is notorious, that initial θ has this force, being also the feminine of the article. In Hebrew, however, it seems to have been less acknowledged than it deserves, that θ or *t* (for we need not distinguish the letters in *Hebrew*, though we must in *Arabic*) is the real and sole mark of the feminine. Indeed the termination *a* often appears to have this force; but this *a* is nothing but a corruption of *at*. This is proved (1), by the

fact that it becomes *at* before a suffix, or in construction, and in the dual *taim*, as in the plural which ends in *tìm :* (2) by the circumstance, that it is within recent history that the very same *t* in the same cases has been lost or retained in Arabic. Thus in older Arabic, *Medìnat* or *Medìnaton*, a city: but in modern Arabic, *Medìna*, when isolated; but before suffixes, or in construction, *Medìnat;* and indeed, whenever they affect to speak finely, they still say *Medìnat*, as in reading the scriptures. And this is an universal observation on words of this form. (3) The termination of the feminine of the third person preterite is in Hebrew *a*, though sometimes *at;* but in the other dialects *at;* which is doubtless the primitive form. (4) The initial *t*, in the feminine of the third person of the *present* tense, corresponding to *y* in the masculine, is equally unambiguous; neither *t* nor *y* admitting of any pronominal derivation. It seems, pronominal marks are in many languages excluded from the third person of each number.—However, the last mentioned use of *t* at the beginning of a word, to indicate the feminine, is not otherwise found in Hebrew or Arabic. (5) The regular formation of the Hebrew plural of nouns that end in *ùt*, is in *uyòt*; as *malkùt*, a kingdom, pl. *malkuyòt*. Here we apprehend that *t* in the plural, as much as the singular, indicates feminine. Whether the termination *òt* (Arabic *àt)* is possibly a corruption of *ant*, a form familiar to the Berbers, might admit of much speculation. The Berbers join then the initial θ of the Copts with the final *t* or θ of the Shemitic languages, as the feminine index; and we cannot but look to a common origin. Yet here also we are a little embarrassed by the *too* great familiarity of *t*. For in the Shemitic languages, it is successively the characteristic of the first and second persons, and of the feminine of the third person; while in Greek and Latin it alternately represents the second and third. Lastly, comparing *Roχ*, pl. *Roχaθ*, with ἐλθὲ, ἔλθετε, fuge, fugite; what is to be thought? *T* is among the very first consonants sounded by children. May the last coincidence be accidental?

We had not intended to be thus diffuse. It is time to make some remarks on the book which has given rise to this article. The title page is in French, and the MS. is reported to have been purchased out of French hands at Algiers. It has been published in London by the Bible Society, in a beautiful type; and, it seems to us, with surprizing correctness, if we are right in supposing that there could be no revision of the press. For the translator we feel less respect. As (we apprehend) one object of the Society, in publishing this small specimen, was to collect opinions on the production, it is with the less reluctance that we venture the following criticisms.

In particular passages the text may seem to have been defective; as in the last verse of the Lord's prayer. But it is a frequent practice of the translator to cut short the matter, from laziness or from false principles of scriptural translation, when there is no excuse from the poverty of the

language. Sometimes his text may vary; as in Luke viii. 23, "*Aggakkanni roχan, igan; iγli agθabχarθ waτo iqwàn; illan itctcarayan aγralγaci;*—As they went, he slept; fell upon lake a wind strong; they were filled with people:" "*Qorban γores iɔðakwal;*—They came near to him to awake him," &c. In i. 59, we read: "On the THIRD day, the days came that they circumcise," &c. In ii. 4: "Joseph went up also INTO Galilee, FROM (or, of) the city of Nazareth, INTO Judea, TO the city of David." In ix. 23: "Let him deny himself, take up his cross, and follow me," he has expressed *cross* by *Ablaτ*, a word which in iv. 3, and elsewhere, has its Arabic sense of *stone*. We apprehend that he did not understand "cross," and perhaps by "stone" understood a burden. Yet it is suspicious, that in xii. 16, *azzad* stands for "Take thine ease," and here, *izad* for "deny himself." However, it may be our own ignorance that makes us marvel. In vi. 27 and 35, "Love your enemies," each time in place of "love," he has used *χamlaθ*, a word which he no where else uses for "love," and which (interpreted by Arabic) means "bear with." But elsewhere he uses *χibb* and *ɛacaq*, both Arabic, and both emphatic. The words, "Thy faith hath saved thee," occur twice; in vii. 50, and in viii. 48. The former place he renders *Δelfaɛlimayakimanɛan*, which we fear means, "Opera vestra tibi salvatoria," "Thy work hath saved thee." Our first thought was, that *faɛl*, which in Arabic means Work, had in Berber come to mean Faith. But, on remembering that Faith had previously been *Lamna*, (once only it is *Dìn*,) and that Believe is *Amen;* and considering the frequent laxity of the translation; it seemed more probable that *faɛl* meant Work. But what says the other passage? *Ayalli, ðelɛalim: ayak imanɛan: roχ sel-xir;* "Oh daughter, be of good cheer; hath saved thee; go in happiness." Here we are perplexed by the entire omission of the word Faith. In our rendering we are quite confident; for *ðelɛali* occurs very often as a salutation or blessing; and here *ðelɛalim!* is, Beatudo vestra! We see no other explanation, than that the printer was induced, by the similarity of the words *ðelɛalim ðelfaɛlim*, to omit the latter improperly.

The Arabic *Djamaɛ* (an assembly), pl. *Djwamaɛ*, forms *Madjmaɛ* (a meeting house), or popularly a mosque: but the Berber writer employs *Ladjmaɛ*, sometimes for a Crowd, ordinarily for a Synagogue, and *likewise* for the Temple; and in vi. 4, for Priests! *Amak ikcam γar waxxam er-Rabbi, yaγi aγrom er-Rabbi, itctcaθ, ifka iwiðak γores, winna or-djoz-ara el-makles, alamayal iladjwamaɛ imanansan;* "How he-entered to the-house of-God, took the-bread of-God, ate-it, gave to-those-who (were) for-him, which is-not-lawful the-eating-it, except for-the-*priests* their-selves." Nor can we tell what to think of his always rendering Pharisee by *Amnay* (qu. A believer? A devotee?). That the Berbers can have in their own tongue any true name for Pharisees is scarcely credible.

Essay on Caerphilly Castle.

No. IV.—PRESENT CONDITION.

(Concluded from p. 143.)

The castle in its present condition, assumes a very different appearance from that which we have been describing as its original state, although enough remains amply to bear out our description, in every particular of consequence.

Along the exterior line of defence to the north-west, the redoubt, covered ways, fosses, and adjacent earth-works, are obscured by young trees and brushwood; by the effects of tillage, and by the buildings of the castle farm.

The moat has in this direction been encroached upon by the Nant Garw road, which tops its outer bank for about one hundred yards.

The demi-lune, or horn-work, covering the western entrance, remains in excellent preservation, and its revêtement is nearly as sound as ever, although its gate-house and western pier, if ever they existed, have been destroyed. The fosse to the west of the horn-work being still the channel of a brook, is overgrown with reeds and aquatic plants; to the east or castle side it is swampy in wet weather, and on the south is the bed of the ancient inundation, now a plain of velvet sward, across which a path leads to the fountain, still in activity.

Upon the southern side of the castle, west of the ruined tête du pont, the land is partly in tillage, and partly occupied by cottages; on the north, the wall between the outer and second moat is reduced to a line of foundation, not a vestige of any gate-house or similar superstructure remaining. The traces of this wall terminate abruptly towards the west.

The eastern or main front is in good preservation. The masonry of the three northern buttresses is but little injured; although between them and the curtain there yawns a deep fissure, evidently the work of gunpowder, though aided by the intervention of the vacuity formed by the long window on either side. The position of the mine in these buttresses, as throughout the whole fortress, has been very adroitly managed, although the quantity of powder introduced in this case has not been sufficient to overthrow them.

The smaller buttresses, towards the gate, on the southern flank, are unhurt, but the two at the southern extremity are laid prostrate, with their connecting curtain fifteen feet in thickness, forming a tremendous chasm, through which the Nant-y-Gledyr takes its undisturbed course. The object of this destruction, which was of course permanently to empty the lake, has been completely fulfilled. The village bridge, a plank, here crosses the stream, resting upon an enormous prostrate mass of masonry.

The lower story of the gate-house, and the piers of its bridge, are in

tolerable order; but the upper chambers of the former, in common with the summits of almost all the walls and buttresses throughout the building, are much battered, and the staircases rendered inaccessible above a certain height, by the absence of the newels, and the fracture of the stone steps.

The great pier stands alone, but the outer semi-pier is encumbered with houses.

The moat, now of no great depth, is occupied towards the south by cottages; towards the north by a garden and fields. In ordinary weather it is perfectly dry, the waters of the river having been, as it appears, artificially blocked out. Between these two portions, north of the pier, is the modern entrance, passing through the grand postern, now a battered hole eleven feet wide: near it a door has been opened into a sort of cavity below the lower story of the gate-house, now used as a cart hovel. The foundations of the southern curtain being in the moat itself, are tolerably perfect. Those of the northern, elevated upon a bank of earth, are much battered, possibly by cannon shot.

The tête du pont, in which the southern curtain terminates, has suffered considerably. Immediately beyond the bridge, are two cavities resembling chimnies in the top of the wall, which is too rugged and ruined to admit of their use being clearly comprehended. The curvilinear wall between the towers is levelled to a breast-work, and the side of the portal towards the lake has been blown quite away, as has been also the entrance and part of the floor of the neighbouring D-shaped tower.

The northern limb of the bifurcated wall, proceeding from the postern, has been blown out of the perpendicular; and, although there is no great danger of its fall, the loose stones adjoining its fissure are a source of danger to the ambitious antiquary, who should here attempt an escalade. Cottages are clustered against the outside of this wall, and the re-entering angle is occupied by a pigstye.

Entering the castle by the grand postern, we find the wall parallel to the curtain, which formed the back of the northern gallery, levelled nearly with the soil, and all regular access to the buttress chambers consequently cut off.

The counterscarp of the inner moat is in ruins, filling up the moat, which lies in tillage and pasture land.

In concluding the outer line of defences, mention should be made of the mill, the lower story of which only remains. A dry water-course, and the tunnel enlarged into a breach, still mark the ancient exit of its waters.

The modern miller of Caerphilly has wisely removed himself to the outside of the great southern breach, where he takes advantage of the Nant-y-Gledyr.

The outer and middle ballia, if ever they were connected at the eastern

end by a bridge, are so no longer; nor have the most careful researches above ground been able to detect any ruins.

The flanking towers of the middle gate-house are destroyed, that on the south completely, and that on the north very nearly so, the ruins of the singular building attached to it having prevented its entire destruction.

At the opposite or western extremity of this ballium, the gate-house is in rather better condition. The portal has been broken away below, but the hollow semi-piers, connecting it with the horn-work, remain. The front of this gate-house, of great thickness, still remains, and is garnished with a pair of chimneys; its inner part, however, has been destroyed. The windows in the front are the only vestiges of the upper story.

On the north front of this ballium, the curtain is much shattered by the fall of the inner towers, and as all the bastions have been ruined and blown up, their exact line of boundary is scarcely traceable.

Upon the southern side, the wide lake, and the strength of the outbuildings, have in some degree preserved the curtain, but the door of the water gate is much injured. A few feet below its sill, a long black stain marks the height of the water in former times, and gives about twelve feet as the average depth of the lake.

The gallery, kitchens, etc., which occupy this side, are much injured: but in front of the great oven a portion of the ancient parapet remains, here about twelve feet high, and furnished with a loop.

The tank is still extant, though nearly choked up with stones and brambles.

Ascending from the eastern gatehouse, across a mass of almost untraceable ruins, we enter the central ballium of the castle, once perhaps the most magnificent court in England, though now defaced and shattered.

With the exception of a partial breach on the northern side, the curtains of this inner ballium have suffered but little, and the height of the parapet and rere-wall may still be inferred, by the projections at its junction with the towers.

The eastern gate-house has been separated by a blast, into two portions; of which the inner, towering to a prodigious height, still remains tolerably perfect, while the outer, absolutely broken into fragments, has crushed the lower gate-house beneath its weight, and still encumbers it with its ruins.

The western gate-house has been more fortunate; the staircases, however, are broken and irregular, and the vaulting of the upper story destroyed. Through the floor of its central apartment, a hole has been broken into the vault of the portal beneath.

In the floor of the triforial gallery are two large holes, which open upon a staircase and passage below.

The buildings within the court have suffered severely. The hall, seventy-two feet long, by thirty-three wide, is roofless, although the structure of its roof is apparent from the remaining corbels, and the pavement has

been long removed. The sills of the windows have been cut away to the soil, and the tracery and moulding which adorned them broken and defaced.

A window and door at the east end have been shattered into one, and the vaulted passage leading to the offices is a shapeless and rugged hole.

The roof of the kitchen is broken, but enough remains to display its original structure. The steps of the water gallery have been removed, but the vaulted roof is but little injured.

Between the hall door and the eastern entrance, a depression in the sward indicates the ancient well. It has lately been opened a few feet down, but nothing of importance was discovered.

We shall conclude this description with the four bastion towers, the position of one of which has conferred upon this castle whatever notoriety it may possess.

Of these towers there are, as has been stated, four; each thirty-eight feet in external diameter, and with a wall of ten feet thick. That they have been mined and blown up with gunpowder, at some period when the effects of that agent were well understood, is evident from a moment's inspection. The mine has been sprung near the centre of each tower, and has produced effects, differing in degree only, upon each. That on the north east is altogether levelled, on the outside entirely to the ground, crushing in its descent the very bastion on which its foundation rested—on the inside, the door, and a portion of wall as high as the curtain, only remain. The destruction of the north western tower has not been by any means so complete. Only a third of its outer circumference has fallen, and the rest, deprived indeed of its floors, remains as firm as ever. The portion which has fallen, lies in fragments upon the neighbouring bastion.

With the south western tower the engineer has been eminently successful: the whole of the outer portion has fallen upon the bastion and into the ditch; but the inner strip connecting it with the rest of the building, and containing the entrances to the several stories, has been protected by the outbuildings on its southern side, and is unshaken.

The last, or south-eastern, is the celebrated leaning tower, the obliquity of which has been so strangely exaggerated and so absurdly accounted for. In the case of this tower, the mine has exploded in a contrary direction from the rest; and the inner portion, with the adjoining curtain, has been thrown into the court, while the two outer and lesser portions remain standing, although the force of the explosion has thrown the mass out of the perpendicular, so that it overhangs its base, towards the south-west, nine feet. The parapet at its summit remains quite perfect, and is the only one in the castle that is so.

The neighbourhood of these four towers, and the intervening gate-houses, upon which the rage of the enemy chiefly expended itself, is a chaos of ruins; subverted masses of the gallery, staircases, nay, the vaulting of large portions of the chambers themselves, lie in confusion upon the

ground; and the thin mantle of vegetation which has enveloped them, although it adds much to their picturesque beauty, increases in no slight degree the difficulty of accurately comprehending their original disposition.

Throughout this immense building, the iron work, even to the staples of the doors, has been greedily removed, nor is there any lead to be found in the sockets of the window bars.

The hewn stone, forming the door frames, window cases, newels of the well staircases, and in some instances the stairs themselves, have been rudely wrenched away, with damage to the walls, for the purpose, probably, of converting them into lime.

Portcullisses, stockades, doors, with the roof of the hall, and every stick of timber in the place, have been removed. Every staircase, gallery, and chamber, is pervious to the autumnal rain, and exposed to the pernicious force of the succeeding frost, yet such and so durable are the materials, and so firm the mortar with which the whole is cemented, that time and weather alone have produced but trifling injuries upon the pile, compared with the wilful destruction of the hand of man.

Before arriving at any general conclusions respecting the age of Caerphilly, it will be proper to make a few remarks upon certain details, on which those conclusions in some measure rest.

And first, of the door-ways. With certain exceptions, shortly to be enumerated, the door-ways throughout the building are of the same general character. The arches are "drop;" that is to say, they are obtusely pointed arches, whose centres lie below their spring. This is obviously the best form of the pointed arch for a substantial edifice like a castle, and it is that usually employed in the military structures of the first Edward. With the same exceptions, the mouldings are of one plain pattern, composed of a pentagonal rib, upon the front and widest face of which, a smaller rib, of the same figure, is placed. This pattern of moulding is also very commonly employed in castles.

The principal portals, together with the doors leading from the first story of the towers upon the ramparts, are defended by portcullises, working in a D-shaped groove. This groove passes up as a chink into the chamber above; but, excepting in one or two cases a scratch in the wall, there is no evidence of the sort of contrivance employed in raising the portcullis. If, however, as was probably the case, the portcullis was substantially of wood, it might have been raised by mere manual exertion, and a bar thrust across would be sufficient to retain it securely when raised. The sills are destroyed, so that it does not appear whether the points of the portcullis were received into or had worn small holes in them. Besides the portcullis, the larger portals are provided with four or five square holes in the arch, through which beams, to form a stockade, might be dropped. It may be observed, further, that although some of the portal passages are of considerable length, yet that the ribs of their vaults are all transverse,

never passing diagonally from an angle towards the centre, in the manner employed at Portchester and elsewhere, to vault a compartment of such passages.

There appear to have been more than one kind of *pont levis*, or drawbridge, employed in this castle. In some places, as at the great gate, and at the passage in its gate-house tower, the bridge, when drawn up, fitted into a depression, so as to lie flush with the upper wall, from whence, therefore, its length may be known. In other cases it simply rested against the wall, making a projection. It seems always to have been long enough, when up, to cover the gateway.

The method of hinging the bridge also varied. On the sides of some of the portals, a stone has been inserted, into which the horizontal pivots of the bridge (of iron, from the small size of the groove) fitted; but connected with the place for the pivot is another groove, which passes up at an angle of 45°, for a few feet, and then passes on horizontally for a few more. It appears as though this were a contrivance when the bridge was raised, for throwing its lower end upwards and forwards, so as more effectually to shield the upper part of the door, to present an oblique surface to missiles, and by making the bridge lean back against the wall, to remove the strain from its chains or ropes, and to prevent it from falling, even should they be broken. It may be, however, that into these grooves fitted some lever, or other contrivance for working the bridge, for their surfaces are not worn, as they must have been had the pivots rubbed along them; and where they occur, there are no holes above for the passage of the drawbridge chains into the portcullis chamber.

The defences of the great postern are singular. The grooves, which in the other cases mark the portcullis slides, here stop abruptly a little above the arch. They are too deep for gates, and were probably filled by a defence similar to a portcullis, but which was received into a cavity below. Indeed, as there is only a lofty wall, and no chamber above the postern, the regular plan was inadmissible.

There is a contrivance for the further defence of a gate, consisting of an oblique opening downwards from the sill of a window, a sort of sink, employed in two places in this castle; the one over the door of the eastern inner gate-way, and the other over the door of the north-west principal bastion towers; in both cases evidently with a view to the holding out the towers, when the enemy had gained the inner court.

The battlements and parapets throughout the castle are of a very plain description. They are massy and flat-topped, the coping being a rough slab of sandstone. Their height and thickness, together with that of the rere-wall and the width of the rampart walk, may be always deduced from a careful inspection of the walls or towers against which they terminate. The parapet and rere-wall are usually of the same height, and nearly as high as the top of the doors leading to them.

The embrasures are contained within parallel sides, and bear a small proportion to the merlons, which latter are each perforated by a loop. These points may be seen upon the summit of the leaning tower, or more conveniently, upon the northern curtain, towards the north-west bastion tower.

There are no machicolations, or contrivances for dropping missiles through the floor of a projecting parapet, a contrivance which adds so materially to the grandeur of the towers of Warwick, Raglan, &c. Over the eastern middle gate-way, the parapet has indeed a slight projection, being supported upon a table of corbel blocks, but there are no apertures, nor is the projection sufficient to admit of any. This is called a false machicolation.

The windows, with certain exceptions, are either loops, or, if larger, of a very plain character. In the hall, however, and in the large rooms of the two inner gate-houses, they are very wide and lofty, and have been highly ornamented. The two latter rooms are so much injured, and the windows so mutilated, that it can only be said that what little remains of ornament are seen, resemble, so far as they go, the more perfect ornaments of the hall. In the eastern inner gate-house, however, at its south end, is a small oratory, of an oblong shape, and with a vaulted roof divided into two square compartments, supported by transverse and diagonal ribs. The two windows towards the south are long and narrow, without a mullion, and trefoiled; their mouldings are only an exterior fillet. This chamber possesses also a small square aperture, towards the north, looking into the great chamber of that gate-house. There are some other windows in the gate-houses, looking towards the interior, which are much shorter, but otherwise resembling this. The hall windows are lofty, well-proportioned, and unbroken by a mullion; and they open to within four feet of the ground. The exterior moulding of the windows is completely gone; that of the door was discovered by removing the grass about it.

The mouldings of the windows are extremely rich, owing to the reduplication of the bands from the great thickness of the wall. The angles of the moulding are at two depths removed, and their place occupied by a semicircular groove, into which the pomegranate ornament is let at intervals, making up the circle by its projection. Beyond each of these bands of pomegranates are pilaster strips, filletted at their angles, and surmounted by small angular capitals: within is a handsome ogee canopy, enriched with crochets and finials, in a very pure style.

The inner mouldings of the door resemble these, but are not carried down its sides; but this needful deficiency has been compensated for exteriorly. Here there are three bands of pomegranates, which no doubt were continued, as in the windows, round the arch; and between them are two rows of small disengaged columns, with the circular concave pedestal. Of these only the pedestal remains.

The corbels, upon which the beam of the roof rested, are composed of

three short clustered columns, connected by their posterior half, and separated by a fillet and bold hollow; above, they are crowned with a neat cap moulding, and below, they rest upon three projecting busts, of which the central is the lowest and largest. It should be mentioned, that a fillet runs up the centre of each of these columns, which, ceasing at the abacus, is continued up the capital, and finally dies into the astragal. Corbels, of somewhat earlier date, but in general appearance resembling these, may be seen in the keep at Chepstow.

There are no decorations remaining about the fire-place. A plain string runs along the east end of the hall, returned from the corbel of the door canopy, and a base tablet is seen at the west end of the north side, though destroyed along its length.

A long window in one of the state rooms deserves mention. It resembles, though on a much larger scale, the windows of the oratory already described. It appears, however, to have been cinque-foiled, with a quatre-foil above the head.

There are two small polygonal apartments on either side of the inner western gate, that should be noticed. In these a plain diagonal rib rises from a corbel on each side, and meets its fellow in the centre. The corbels present three flat faces, and terminate in a point, which rests upon some animal, in every case wantonly defaced. So very little is really known of the appropriation of the different apartments in castles, that it would be idle to guess at the uses of these.

Caerphilly presents as little architectural decoration in proportion to its extent, as any castellated building in Britain.

Its plan, its series of concentric defences, and the general disposition of its constituent parts, resemble those of Conway, Harlech, and other structures known to have been erected either by Edward the first, or some of his barons. The plan of these Edwardian castles is very peculiar. It is unlike the earlier Norman castles, in which the keep was every thing, its walls inordinately thick, and in which comfort was entirely sacrificed to safety; and it is also unlike the later castles, in which the walls were not remarkably thick, and which possess not only large interior, but large exterior windows, as in the later alterations at Portchester, and in which there is often no building to which the name of keep could be attached, as for instance at Coity.

Nor is the style of architecture employed at Caerphilly less decisive; the drop arch, the perfectly plain rib, the general absence of decorations and armorial bearings, the plain battlements, and the absence of machicolations, indicate generally the same period.

The disengaged columns of the hall door-way, and their concave pedestals, the triple cluster of columns forming the corbels of the roof, their bell capitals, and light cap moulding, are due to the early English style (that of Salisbury), which prevailed from 1189 to 1307.

On the other hand, the pomegranate moulding,* the rich, though chaste canopies of the door and windows, the little pilasters in the windows with the pentagonal capitals, the ogee arches, and the plain fillet running up the columnar corbels of the roof, are marks all belonging to the "decorated" style, which prevailed in England from 1307 to 1377.

The mixture of these two styles, very common in English buildings, denotes a period varying according to the preponderance of either, and in the present instance may faithfully and legitimately be referred to the reign of Edward the first, when the decorated style was beginning to supersede the early English throughout the country. Instances of this transition, and of the pomegranate moulding, may be seen round the inside of the choir of Bristol Cathedral, and on the outside of the south aisle of Keynsham church, the windows of which, however, are perpendicular.

The earlier alterations at Chepstow, and more particularly the oratory attached to Marten's tower, and the columnar corbels in the keep, are of an earlier date than Caerphilly, having been evidently placed there before the decline of the early English style.

With respect to the evidence of history, it appears that up to the year 1270, or thereabouts, the castle of Senghennyth was occasionally destroyed and rebuilt, but that its site then fell into the hands of Gilbert earl of Clare, a powerful baron, Edward the first's son-in-law, and therefore a very likely man to have erected a castle like the present.

Admitting the castle to have been founded at that period, a question arises as to whether the whole of it was then built. Upon this point we would wish to speak with diffidence, arising from the absence of all architectural ornament in many portions of the castle, and the want on our own part of a sufficiently critical knowledge of ancient masonry. We think, however, that the inner ballium, all its contents, and almost all its appendages, are of the same date, and as old as any other part of the castle. With respect to the curtains, bastions, and gate-houses, there can be no doubt; and though it be doubtful whether the water-gallery and kitchens were part of the original plan, yet it is certain that the south wall was always of its present height, and therefore always intended to support the roof of the hall. The walls of the hall also appear to be bonded closely into that of the curtain; and to remove any further doubt, the window of the state rooms, and those of the oratory in the inner gate-house, are in their form and mouldings precisely similar. The gate-houses are evidently part of the original plan, being thoroughly Edwardian; and it is extremely improbable that the window in the state rooms should be older than those rooms themselves.

* The pomegranate moulding is composed of a number of balls, set at intervals in a concave moulding. Each ball represents a flower of three petals, separated by open spaces, and each passing towards the centre to enclose a small sphere. An ornament at first sight somewhat resembling this, is observed in early English structures.

It appears, however, that the curtain connecting the north-west bastion tower with the west gate-house, was originally as low as the northern curtain, but that the triforial gallery and its superincumbent rampart, and some exterior buildings, have been added. A cluster of buildings has also been added on the outside of the south curtain, at the angle formed by its junction with the south-west tower.

It is very possible that the gate-houses of the middle ballium are of later date than the interior works. That on the east is too mutilated to admit of any inference at all, as to its age. But on the west the false machicolations, the holes for the portcullis chains, the chimnies rising above the parapet, and the less durable character of the masonry, seem to be decisive. The walls, moreover, by means of which this gate-house is connected with the curtain of the inner ballium, though of the same age with the former, are not bonded into, and are separated by fissures from, the latter,—a tolerably sure indication of difference of age.

To the same date, perhaps during the reign of Edward the second, we should be disposed to refer the whole exterior line of defence on the east, and the horn-work on the west. Neither are much later, for the general appearance of the former is decisive, and the revêtement of the latter is too nearly perpendicular and too slight to resist even the rudest kind of artillery.

With respect to the redoubt, it is perfectly evident from its appearance, that it was thrown up, not only when gunpowder was in general use, but when the science of fortification was pretty well understood. It seems, with the earth-works at Donnington and other castles, to be fairly referable to the period of Charles the first.

The injuries received by this castle are similar to others at Corfe and elsewhere, known to be referable to the same period, in the international struggles, of which the battle of St. Fagans and the occupation of Cardiff prove the men of Glamorgan to have taken an active part. Nothing therefore seems more probable, than that the redoubt should have been thrown up hastily by one party for the defence of the castle, and that the dismantling of the whole should have been perpetrated by the other, to prevent such a defence being practicable in future. History, however, has afforded no clue as to which of the contending parties either proceeding is to be referred.

It seems to us a mistake to consider that the works of Caerphilly were never completed. The flanking towers on either wing rest upon the lake, and the horn-work is surely a sufficient defence in the opposite direction.

In concluding this Essay, its author is desirous of acknowledging the kindness of the noble owner of the castle, in placing a copy of a very excellent plan, lately constructed by Mr. Turnbull, at his disposal.

The traveller who visits Caerphilly, will find there an excellent inn; and if he be fortunate enough to meet with Mr. Evans, he will find a guide who will render of but little use the information contained in this essay.

Postscript.—Since the former part of this essay went to press, the author has received from a friend, far more competent than himself to write upon these subjects, and to whom the county of Glamorgan has long looked for its history, a letter, from whence the following passages are extracted.

Among Lord Bute's papers is the account of Thayron ap Jevan ap Rawlyn, Bayliff of Kerfilly, 16th H. VI. "Unde 3*s*. 6*d*. quor̃ solvit p expen̄s Oweyn ap Gwed et Jevan Llewn ap Jevan Vaughn̄, ap Jevan Vaure Felon ibm̄ in Co. de Kerfilly exist̄ p iij. Septim̄ et postea suspens̄." This original document is confirmative of Leland's account, that prisoners were kept here in H. VIIIth's time.

The statement of the descent of the castle to its present owner is defective. H. VII. certainly granted it to Jasper, Duke of Bedford, at whose death in 1495 it escheated to the crown, in whose hands it remained, until Edward VI. granted it to the Earl of Pembroke, in the fourth year of his reign. Caerphilly was never possessed by the W. Earl of Pembroke, who was beheaded in 1469, but by William, E. of P. the favourite of Edward VI. who was the son of Sir Richard Herbert, of Ewyas, the natural son of the Earl beheaded in 1469.

During the reign of Edward III. large levies were not unfrequently required at the hands of the Lords Marchers of Wales; and among the territories from which certain men are directed to be drawn, the name of Ewyas Lacy very frequently occurs. Thus, in 1343, (16th Edward III.) a writ was addressed to Gilbert Talbot, Justiciary of South Wales; in 1346, a similar one to the Earl of March, and B. de Burgersh; in 1367, to other persons, and in each of these cases, Ewyas Lacy is enumerated in conjunction with Builth and Crickhowel, and other places, all lying about Brecon, or between it and Crickhowel, while the levies for "Morgan and Morgannon" are in all the above cases directed to be raised by a different baron; Ewyas Lacy, indeed, is in Herefordshire, not far from the border. The name Gwyr Lacy does not once occur in the Fœdera: it is evidently a misnomer.

Hugh le Despencer, Jun. does not appear to have acted as military governor of Caerphilly, during its siege by the queen and prince, but either to have resided in it supinely during that period, or to have left it with the King: for in 1347, (20 E. II. Rege Captivo) a pardon is issued to John de Felton, for holding out Kerfilly against the queen and Prince Edward; and a similar pardon to all within the castle during the siege, excepting only Hugh, the son of Hugh le Despencer the younger. Fœdera 20 E. II.

In an account of the possessions of Hugh le Despencer, and Eleanor his wife, 14 Ed. II. (a copy of which appears in the Harleian MSS.), the sum for the necessary repairs, &c. "de necessaria reparatione et custodia Cast. de Kerfilly," is estimated at £43 per annum.

The name of "Sengenny" appears in a dateless deed, entitled "Protectio

Morgani filii Cadwalan," among the papers at Penrice Castle, Glamorganshire. "Oms hoies de Brechineoch et Sengenny." The sons of this Morgan passed a fine at Cardiff in the year 1249.

From the publications of the Record Commissioners, we learn that in the 8th of Edward II. the following persons were governors of Kerfilly: Ingelramus Berenger, John de Everdon, and Bartholomew de Badelesmere; and in the 9th year of that king, Payne Turbervill filled the same office. In the 20th of Ed. II. John de Felton was superseded as governor by Roger de Chandos. Soon after, the king committed the custody of all his "treasures of gold and silver, armour, victuals, and all other goods and chattels," in the castle of Kerfilly, to Thomas de Londres. In the 1st of Edward III. William de la Zouch and Wm. de Anne are mentioned as governors, as is Peter le Vele (of St. Fagan's Castle), in the 4th of Ed. III. (1330.)

Rees Meyrick, whose MS. history of Glamorganshire, 1578, is extant in the library of Queen's College, Oxford, notices the castle, which he says is environed with a "mear of water of the south, and marisch ground of the west and north part, and doubly moated."

It should have been mentioned that the triforial gallery is called the "Braose gallery," and the gate tower, the "Wassail tower."

There is an old building near Caerphilly, called the "Van," the materials of which are said by tradition to have been drawn from the castle. The author regrets that he has been unable personally to examine into the truth of this tradition; but he is assured by competent authority, that the appearance of the materials renders it highly probable.

The etymology of Caerphilly seems to be, Caer, *a castle;* Pwll, *a morass.*

Erratum.—Page 65, line 14, *for* "twelfth," *read* "thirteenth."

Upon reviewing these pages, and considering that before the final conclusion of a subject, it is desirable to make it as complete as possible, it has occurred to the author that a short sketch of the subjugation of Wales, and the causes which led to the erection of the numerous castles with which the principality is bristled, will not be an inappropriate addition to the former parts of the essay.

It would appear, then, that at the period at which Caerphilly was erected, Edward, the first of the name since the accession of the Norman dynasties, occupied the throne of England. This monarch succeeded to that throne under advantages, which, if they were in some measure due to the condition of the kingdom, weary of the intestine broils of the preceding reigns, and of the rapacity of the Roman pontiffs, were in at least an equal degree to be attributed to the respect with which his own conduct while prince had inspired the subjects of his father. Edward had already shewn a personal courage and coolness, which, in times when the general entered himself into the conflict, peculiarly qualified him for a leader in war; and

a respect for the charters and immunities of his English subjects, calculated to make him equally respected during peace; and which, though probably forced from him unwillingly by the exigencies of the time, was not the less favourably contrasted with the behaviour of those who had immediately preceded him.

Inferior to his great predecessor Richard in chivalrous valour, he was equally brave in the field, and more equitable, because less impetuous, in the council-chamber; and if inferior to his grandsire John in low craft and cunning, he still possessed sufficient knowledge of mankind to select able counsellors, sufficient strength of mind to direct and control the ambition of his nobles, and sufficient consistency of character to carry his designs steadily into effect. His views of policy were enlarged and securely laid; some of them took effect during his life, others came to pass at a subsequent period, and the lapse of centuries has attested their wisdom. Unlike his father and his grandfather, and equally so to his ill-starred son, he never acted without a sufficient reason, nor left a design, when once entered upon, incomplete.

But a very principal scene of Edward's labours, and the object of his most successful scheme of policy, lay in the principality, upon the southern extremity of which the castle which we have been describing is situated. Wales, from a very remote period of history, had been an object of enmity with the inhabitants of England, from whatever source derived. Sprung from the ancient Celtic population of the island, their rugged mountains had enabled them to resist the invaders before whom their less fortunate brethren of the plains had lost their existence as a nation; and to retain their own laws, language, and princes, unaltered, amidst the general commixture of Roman, Saxon, and Norman, by which the less mountainous parts of the island had been completely overrun.

Soon after the Norman conquest, Fitz-hamon, a great baron, nearly allied to the Conqueror, won by his sword and by treachery the fertile territory of Morgannoc or Glamorgan; slaying such of the inhabitants as refused to submit, or driving them to the mountains, to be replaced by Norman colonists. Fixing upon Cardiff as his principal residence, he there constructed a castle, and portioned out the newly-acquired territory among his twelve principal followers, constituting himself their feudal chief.

Other adventurers, following the example of Fitz-hamon, and assisted like him by the internal dissensions of the natives, and the treachery of the losing party, acquired lands upon the borders of Wales, and were constituted by the English monarchs, lords-marchers. In this manner the fertile plains of the border were gradually acquired by the Normans, though not without considerable loss and continual disquiet from the outbreaks of the Welsh, whose inherent love of liberty permitted them not to remain cooped up in their mountains, while their enemies calmly enjoyed the richest portion of their ancient inheritance.

The condition of Wales, during the reigns of the Plantagenets, demanded a great and increasing share of the attention of both monarch and nobles; but the internal dissensions of England rendered her foreign policy infirm and vacillating, so that, although the Welsh were occasionally attacked with fierceness, no settled plan of conquest was put in practice against them; nor was it for the interest of all parties that such a measure should be adopted. The kings, indeed, found in their undisciplined valour and the inexpugnable strength of their mountain fastnesses, a perpetual source of distrust and disquietude; but the lords-marchers, often in rebellion against the crown, found the ready alliance of the Welsh extremely useful, and were thus not only encouraged to rebel, but their punishment was rendered proportionably difficult.

But that which the force of arms had failed to execute, the internal feuds of the Welsh brought to pass much sooner than it would probably otherwise have happened. Llewelyn, prince of Wales, being old and broken, and incapable of defending himself against his unruly children, sought voluntarily protection of Henry the third, did homage for his principality, and bound himself to pay an annual tribute; and as even in those lawless and rapacious times, the colour of a legal claim was as eagerly sought after, as in its absence it was disregarded, this gave to Henry and his son a claim upon the sovereignty of Wales, of which they were not backward to avail themselves.

Edward, upon his accession to the throne, vigorously pushed forward the plans which had already been commenced against the Welsh. The destruction of the native princes Llewelyn and David, one of whom was slain in battle, and the other put to an ignominious death, removed all regular opposition to his claim. The southern and south-eastern provinces had already been reduced to subjection, and forced by the presence of numerous garrisons, to exchange their unbridled liberty for the constraints of a partial civilisation. Edward reduced the whole of the country to the same state of submission to his will; and by his great military road insured a free communication between the numerous castles which he caused to be erected, for the preservation of his hard-earned but valuable conquest.

The investiture of his surviving son, Edward of Caernarvon, with the principality, marked the permanence of his sway, as well as the high importance which he attached to it; and thus after having without ships, alliances, or commerce, maintained their liberty upwards of a thousand years; and, after having defended their native mountains with a perseverance which might have deserved a richer country, but could not require a better cause, were the Welsh incorporated with the English. The politician is indeed aware that the conquest of Wales was and is a benefit to both countries; but the enthusiastic native may be permitted to lament the lost independence of his country, and the gradual extinction of his ancient and hereditary tongue.

The dominion of Edward, though finally complete, was not achieved without a vast number of petty insurrections on the part of the indignant Welshmen; and the monarch, well aware that steady and uncompromising severity was the only method of securing his conquest, and jealous of the influence of those nobles whose estates occupied the border territory, and whose office of lords-marchers obliged them always to retain an armed force, often visited Wales; and spent as much of his time in his Welsh castles, as the important affairs of the rest of his kingdom would safely permit.

GEO. T. CLARK.

ESSAY INTRODUCTORY

TO THE

ARCHÆOLOGY OF THE WEST OF ENGLAND.

PART III.—LANGUAGE.

Agreeably to the plan sketched out at the commencement of this Essay, we are now about to enter upon the examination of the philological remains of those successive inhabitants of Britain, whose origin and history have already been pointed out. And it may be observed, that this is a branch of Archæology, which, if not the most popular, is decidedly the most important, and in many respects by far the most interesting.

Christina of Sweden said of the celebrated Vossius, and the anecdote has been transferred to Ménage, that he was the most troublesome person in the world; for he made every word produce its passport, and declare whence it came, and whither it was going.

Any attempt to analyse a language, to discover how much it owes to one, and how much to another source; what words it possesses in common with other languages, and how such community has been brought about; what are its grammatical forms, what its idiomatic expressions; by what progress it has attained a certain degree of perfection, and to what changes it remains still liable; these are subjects, not merely for the curious speculation of those by whom it is spoken, nor for the exercise merely of antiquarian industry; but which are connected closely with the business of every day life:—since nothing conduces more effectually to a full and complete acquaintance with the powers of our own tongue, than an acquaintance with the primitive and simple terms, out of which its more elaborate superstructure has been constructed, and which it possesses in common with others of an identical or cognate original. For, although the sense and definition of a compound word may no doubt be very accurately learnt by a reference to the vocabulary or lexicon, yet it will best conduce to the apprehension of its full force and meaning, its large and round-about sense, to be informed whence it originated, by what steps and through what

changes it attained its present orthography and signification, and how far or under what modifications it has been admitted into other languages or dialects.

Words record the advances of memory, reason, and imagination, the three great faculties of the human mind, under the pursuits of history, science, and art. The ideas at first represented by them were simple, and their number limited; and their gradual progress from these primitives to secondary and compound words, forms an important branch of Philology; for it should be remembered, that words represent facts concerning the habits and manners of mankind, and that the analytical study of a vocabulary is the study of the progress of the human mind.

With respect to the practical advantage of Philology, it is well known to all who have paid attention to the degree in which language penetrates the understanding of that very numerous class of persons, whose education has not made them familiar with the meaning of words whose primitives are adopted from a foreign tongue, that whoever wishes to be perfectly understood by that class must employ the words of the mother tongue of the country, else the words will rather be interpreted by the general sense of the sentence, than the sense by the words.

Each primitive in the native tongue being significant, its compounds will be significant also, however far they may be carried; whereas the terms, which the superior art or science of foreign nations may have introduced, will remain but obscurely comprehended by the less educated class, and will not therefore in their, that is in common, parlance, be very prolific in further compounds.

Thus in England, words of Saxon etymology are understood at once by the people; they are grasped with a strength and conviction of their meaning, but rarely yielded even to the most familiar words of Greek, or even of Latin pedigree.

Concerning the elucidation of those earlier ages of national history, upon which the light of history had not dawned, or which it has but obscurely illuminated, all evidence becomes of augmented value, and that of Philology is peculiarly important. Excepting the evidence, at present incomplete, derived from the consideration of the external physical characters of the human frame, language is the chief, if not the only monument of their origin retained by each race of mankind; and it is one, which though subject to very considerable mutations, yet, being universal, affords a clue towards the estimation of their history, and one, the mutations of which, however considerable, are reducible to rule; and wherever a sufficient degree of attention has been paid to those mutations, Philology has assumed the form and stability of an inductive science. It was only the wildness and absurdity of conjectural philologers, that brought that science into its former disrepute, and in a great measure blinded mankind to its exceeding importance.

We have already seen that Britain was peopled by successive races of invaders, who established themselves with various success and duration in that country.

We are now to examine into the traces of their language which each has left behind it, how far each has contributed, and in what department, to compose our present vocabulary; and what inferences may thence be drawn respecting the degree of civilisation arrived at by each, the manner and extent of their occupation of the country, and how far the inferences derived from philosophical inquiry alone, correspond with the information derived from other sources, more particularly that of history.

If we examine into the vocabulary of our tongue, including, of course, the terms of its geographical, topographical, and personal nomenclature, we shall find words evidently derived from many distinct idioms; such as the Celtic, the Latin, the Saxon, perhaps the Danish, the Norman French, and of later years, so far as relates to our scientific terms, the Greek. We shall find, as we proceed further, that these languages have in many cases applied themselves to particular classes of objects or ideas.

Thus the names of certain of the great features in the physical geography of the country,* of some of its mountains, of almost all its rivers, of its plains, of its principal modifications of land and water, are significant only in Celtic; and are closely akin to the names of similar objects, in those countries which the Celts still inhabit, or are known formerly to have occupied. (Note A. at the conclusion of this Article.)

Nor are Celtic names confined exclusively to these; we trace them, though more rarely, in the appellations of hills, brooks, caves, and the lesser irregularities of the soil; and when such appellations are observed to be scattered, however thinly, over a certain tract of territory, the induction is as clear, that their language was once spoken over the whole, as it is that the space between an outlying hill, and the heights with which it exactly tallies, must have been at one time occupied by a similar series of rocks.

The names of those topographical remains that are known to have been erected by the Celts, cannot be cited in support of this argument. They are due to Dr. Borlase, whose book is in some measure pure fiction, and is full of confusion between natural and artificial remains.

Descriptive in the Celtic tongue also, are the names of some few of our lesser territorial divisions, such as counties, hundreds, or parishes; and in one or two cases of our cities, but these are for the most part of rare occurrence. (Note B.)

Excepting certain names, which may be traced in later times to the

* The names of places upon the coast are rarely Celtic; the British were not a maritime people. From circumstances of this nature, the habits of particular nations are often evident. The reader will remember the conversation in the opening chapter of Ivanhoe, in which the terms employed shew the superiority of the Norman cookery.

provinces in which Celtic is still spoken, Celtic names of persons are very rarely, if at all, found amongst us; and above all, none of our political or judicial terms, nor any of the words of the written or spoken English language, can be ascribed to the Celtic source. (Note C.)

We have, then, many of those names which are the first given, and the last to change, Celtic; evincing that Celtic names must at one time have been received every where, although the influx of a different and more polished tongue has ejected them from their less impregnable holds.

Hence we must conclude, in accordance with what history teaches us, that Celts were the most ancient inhabitants of our island, and that they spread themselves over the whole of it; that they were invaded by nations who either did not attempt, or did not succeed in their civilisation, but drove them forth whenever they met with them; and finally, having possessed themselves of their fairest provinces, cooped them up and isolated them in those mountainous tracts, of which they are still the inhabitants.

It being then demonstratively evident that the Celtic was the ancient language of Britain, as it still is of some part of her dependencies, it will be proper to consider that language in detail.

Dr. Prichard, who has in one short tract thrown more light upon the relations of the Celtic to other idioms, than all former writers, save Edward Lluyd, put together, has examined the Celtic analytically; that is to say, he has taken the points of resemblance between it and other tongues, and has examined how far their coincidences denote a common origin, or common laws of mutation.

These relations Dr. Prichard has reduced to four classes.

I. Those languages whose grammatical structure discovers little or no analogy, but whose vocabularies possess a number, more or less extensive, of similar terms for particular objects, actions, and relations, introduced, it may be, by conquest or commerce, or the diffusion of religion, science, or the arts; in which cases the new words will be confined to the new introduction; or they may involve words of a class expressive of simpler ideas and universal objects, when they will be primitive, and indicate an earlier and more intimate connexion. Similarities of this latter class may be so numerous as to indicate a common origin, though different degrees of culture may cause them to differ in sense.

II. To this class belong languages which have few *words* in common, but whose grammatical construction is remarkably analogous.

III. Other languages are connected in both the above ways, possessing a multitude of words in common, and a similarity of grammatical forms.

IV. To the last class are referred languages possessing none of the above characters of connexion, and belonging to nations remote from each other in descent, and often in physical character; though even here are found verbal coincidences too remarkable, perhaps, to be accidental.

It is upon a series of striking analogies between the Celtic and other

admitted Indo-European languages, that Dr. Prichard has claimed for the Celtic a place with them in the third of the above classes; and has considered the Celts as of identical origin with those nations who spread from the shores of the Indus over Europe, from what has been called by philologists the Indo-European stock.*

There are found in the Celtic dialects of the present day, two distinct classes of words, closely resembling the Latin. Of these the first class are chiefly primitive words, expressive of simple ideas; such, for example, as the following.

Welsh.	*Latin.*	*English.*
Amon, or Avon	Amnis	River
Auyr	Aer	Air
Dyn	Deus	God
Fynnon	Fons	Fountain
Ki	Canis	Dog
Llyg	Lux	Light
Mam	Mater	Mother
Man	Manus	Hand
Mor	Mare	Sea
Mynnydh	Mons	Mountain
Oen	Ovis	Sheep
Ogof	Fovea	Cave
Pysc	Piscis	Fish
Tir	Terra	Earth

and many others. The words of the second class are more numerous.

Welsh.	*Latin.*	*English.*
Albalaster	Arcubalister	Arblast
Alium	Alienus	Alien
Aradr	Aratrum	Plough
Arian	Argentum	Silver
Avoultr	Adulter	Adulterer
Pedhester	Pedester	Footman
Abad	Abbas	Abbot

* The Indo-European hypothesis is a modern one. In the works of one of its earlier advocates, speaking of the connexion between the Sanskrit and the Latin, occurs the following striking passage. "Quod admirationem auget, est, affines istas dictiones non esse nomina nummorum, quæ ex uno orbis limite ad alium transeunt, non clypei, non hastæ, non plantarum exoticarum, non peregrinarum mercium, quæ aliena et adventitia vocabula in disjunctas orbis partes invehunt; *sed esse primævæ societatis elementares dictiones, naturæ et mutuæ necessitudinis nomina, quæ cum societate oriuntur, crescunt, et adolescunt.* Hæc ratio et causa jamdudum me induxit ut crederem, veteres Indos et Latinos in remota antiquitate unius stirpis homines fuisse et ab uno stipite descendere, in cujus familiæ, rudis ille quidem, sed unus primordialis sanscrdamicus sermo vigebat." Bartolomeo, de Latinæ Origine, etc. 1802, cited by Schæll.

Welsh.	*Latin.*	*English.*
Apostol	Apostolus	Apostle
Drindod	Trinitas	Trinity
Eglwys	Ecclesia	Church
Esgob	Episcopus	Bishop
Temmel	Templum	Temple

The words of the first class are supposed to be derived immediately from the same source with those of the early settlers in Italy. They express the elements, the geographical features of the country, the necessaries of life, cattle, domestic instruments of the rudest kind, and the ordinary actions and passions of the mind; terms which every language must have possessed from its commencement.

The words of the second class, introduced from the Latin, express ideas connected with the arts and sciences, the habits of social life, the refinements of mental operations, and, above all, terms in Theology, all plainly incongruous with the habits of savage life, and introduced, together with the words that express them, at a later period.

The words of the former class we should expect to find in every dialect of the Celtic; those of the latter would vary according to the degree of the subsequent intimacy between any particular branch and the Romans: and, accordingly, these Latin introductions are said to be more abundant in Cornwall, because the southern and south-western tribes of Britain were earlier subdued by, and more intimately conversant with the Romans, than the rest.

There are some few words of a mixed character, the date of whose introduction it is not easy to determine.

Thus we have the Latin Carus, dear, and the Welsh Kar, a friend, and all its derivatives, such as Kariad, a mistress, etc. When, however, as in the present instance, a corresponding word occurs in the Erse, the presumption is in favour of its being primitive.

It is obvious that the influx of a later upon an earlier branch of any language, must be productive of considerable etymological confusion.

Our knowledge of the Celtic language is derived chiefly from its extant dialects; these are, principally, the Cambro-Celtic, Cymraig, or Welsh, and the Iberno-Celtic, Erse, or Irish: and the differences between these dialects are considerable, and evidently have not sprung up at a late period, but have existed from a remote age, when their stock was in its infancy. It will be seen presently, that each possesses many primitive terms, of which the other is destitute.* The Erse was indeed formerly supposed to be Celtic, with an infusion of Basque.

Of the Cambro-Celtic, the Cornish and the Armoric or Bas Breton are

* The following words, expressive of primitive ideas, and selected from the five Celtic dialects, will shew the different form under which similar words exist; and,

to be considered as subordinate varieties; agreeing in grammatical structure, and generally in orthography, but more closely resembling each other than the Welsh, but the Cornish being more like the South Welsh than the North.* Of the Iberno-Celtic, the varieties are the Scoto-Celtic or Gaelic—the difference between them being very slight—and the Manks. There exist also certain slight differences between the Welsh of North and South Wales, and between certain of the districts of Brittany, as the Vannes and others. The Cornish has now become a dead language, and the Manks, from the insignificance of the island, has always been an inconsiderable one.

The extinct dialects of Belgic-Gaul and Belgic-Britain are considered by Dr. Prichard as akin to the Erse, rather than to the Welsh, and some writers have conjectured that the colonization of Ireland was contemporary with the invasion of Iberia; while the later influx, of whose language they

especially, that the two typical dialects, Welsh and Erse, possess, each of them, many words unknown in the other, although indeed sometimes to be detected in composition.

Welsh.	*Armoric.*	*Cornish.*	*Erse.*	*Manks.*	*Latin.*
Gwraig		Gureg	Gruag, Frag		Mulier
	Femellen		Fem, Femen		Fœmina
Benw		Bennen	Beau, Veau		
Gwr, Wr		Gur	Fear		Vir
Tad	Tat	Taz	Athair	Ayr	Pater
Mam, Mammaeth	Mam	Mam, Dama	Mathair, Naing, Brinneak, Benaltra		Mater
Brawd	Breur	Bredar	Brathair		Frater
Cuar, Chwaer	Chuar	Hor, Huyr	Siur		Soror
Merk	Merk, Merket	Merk, Muk	Nigh		Filia
Lheyver		Sklerder	Ingean, Dear		
Gwawl, Golen	Golou		Fordhark, Ban, Les, Solus, Reil, Gogor		Lumen Flamen,
Haul	Heol	Houl, Heul	Grian		Sol
Lheuad, Lhoer	Laor	Lâr	Luar		Luna
Seren	Steren	Sterran	Realt		Stella
Nen	Ceuf	Nev	Neav	Niau	Firmamentum
Nivwl, Kummul	Kunabren	Goruer, Nibren	Neal		Nubes
Dûr, Duvr, Avedhur, Esg	Dur	Dour	Dovar, An, Ean, Byal, Bir, Gil, Fual, Lo, Easkong, Oike, Eask, Beathra		Aqua
Pen	Pen	Pedn	Kean, Koll, Kuth, Gart, Trull, Toll, Itros, Ben		Caput
Avon, Frûd, Nant, Karrog	Gueryin	Avan	Avan, Dothar Sruth, Snudh		Amnis
Mynydh, Bre, Brynn, Moel, Garth, Galht	Menedh	Monedh Menydh	Knok, Mullak Mual, Sliav, Mam, Ard, A, Bri, Aighe, Dun, Aisgeir, Neas, Ais, Kodadh		Mons

* The Cornish more nearly resembles the Erse than the rest, and the Armoric appears to have adopted most Teutonic words.

consider the Welsh to be the representative, remained longer in the East, and never extended their possessions beyond Gaul and South Britain. It has indeed been shewn, that a dialect closely resembling the Erse has contributed with the Greek to form the Latin tongue, but the points of difference and coincidence between the Celtic dialects have not yet been sufficiently examined into, to throw light upon the whole hypothesis.

The narrow limits of this essay, independently of more cogent reasons, will not admit of the detail requisite for comparing satisfactorily the extant Celtic dialects, so that we must content ourselves with a few observations respecting their differences, a method of examination, the reverse of Dr. Prichard's, but which it is obvious must be adopted, when the growth of dialects from a parent stock is to be estimated.

The changes, to which Celtic in common with other languages is liable, are of three kinds, literal, ideographical, and grammatical, the former affecting the orthography and signification of the word, the second its sense or meaning, the latter its inflections.

Thus words obsolete in some dialects are retained in others: Kall, *crafty*, Maur, *great*, and others, are retained in Welsh but are obsolete in other dialects.

Another class are transpositions due to careless pronunciation, Brecon for Brecknock, etc. Another, transpositions of whole syllables, Kyn-vael for Mael-gun ; Iltyd for Tydvil.

Sometimes letters are omitted, and changes made to facilitate pronunciation: thus Cassibelan becomes Cassivelan. These are partly grammatical, or the initial syllable may be varied, as in the Welsh Guan, *week*, which becomes in Erse, Anvan. Though the difference in most cases, as perhaps in this, depends upon a separate prefix.

Nations usually adapt the terminations of foreign words to the rules of their own language. The Romans thus altered British words, and the Britons Roman. Some of those Greek or Latin technical terms, which, from their connexion with Christianity, became suddenly adopted into a great many languages, display this rule remarkably. Thus ἐπίσκοπος, or Episcopus, becomes in Italian, Vescovo ; in Spanish, Obispo ; in French, Evesque, or Evêque ; in Hungarian, Pispok ; in German, Bischoff ; in English and Dutch, Bishop ; in Welsh, Esgob ; and in Erse, Easbog.

But by far the most extensive class of literal differences, are those which arise from the permutation of one letter into another. Thus all letters in the articulation of which the same parts of the organs of voice are concerned, are mutable into each other, labials into labials, etc.

Also certain letters of one class in one language, are mutable into certain letters of a different class in another. Thus the labial P, in Welsh, becomes in Erse, C or K : Paul, *a pole*, becoming Kûal ; Pen, *a head*, Kean, etc. ; just as the Greek λύκος, *a wolf*, becomes in Latin, Lupus ; or κ, in the Ionic and Æolic, became not unfrequently π in the other Grecian dialects :

ποῖος, ποία, ποῖον, in Æolic is κοῖος, κοία, κοῖον; in Latin Qui, Quæ, Quod, and in the dative, Cui; in Welsh and Armoric, Pi, Pa, Piad; in Erse, Ci, Ce, Ciod. Thus also the old English, Cod, *a husk*, is now Pod. Some races seem to dislike, or adopt certain letters: the Italian substitutes I for L, Piu for Plus; and the Latin F becomes H in Spanish, Filius, Hijo.*

Besides these changes, which are strictly literal, are another class, in which the idea expressed varies, without any material change in its corresponding word. Thus Britilh, *a trout*, in Welsh, means in Cornish and Armoric, *a mackerel;* Krôg, *a cross*, in Armoric is *a gallows;* Kynvoeth, *riches*, in Erse signifies *power*.

The introduction, in different degrees, of foreign words, we have already seen to be a fruitful source of dialectic differences. We now approach the most important class, the differences of inflection, or in grammar.

ARTICLE.

The Welsh language appears to use the article sparingly. In Cornish, Armoric, and Erse, 'an' answers to the English definite article 'the.'

NOUN.

1. Number. In Welsh the plural is formed either by simply changing the vowels of the singular, as Carreg, *a rock*, Cerrig, *rocks;* or by the addition of a new syllable, joined to a mutation of the vowel, as in the former case. Thus, Pwll, *a creek* or *morass*, Pylau.

In Cornish and Armoric the plural is formed by adding a new syllable to the singular termination; the most usual addition is 'ou,' Bedh, *a grave*, Bedhou.

In Erse the plural is formed by adding to, or otherwise altering the singular termination; the most prevalent addition appears to be 'a;' Fogmar, *harvest*, Fogmara.

2. Gender. The Celtic dialects possess only the masculine and feminine genders, which are distinguished by their terminations. They are formed also in Welsh and Cornish, by changing the initial consonant for its aspirate.

3. Case. In Welsh the relations belonging to a noun in the construction of a sentence do not influence its termination, but are denoted by the prepositions, and by substituting for the initial consonant of the noun, as it stands out of construction, its several commutable letters: thus, Pen in construction becomes Ben, Phen, Men, and Mhen. These initial variations may certainly be considered as cases, since certain forms are constantly

* *Welsh.*	*Armoric.*	*Cornish.*	*Erse.*	*Gaelic.*	*Manks.*	*Latin.*
Dydh Syl	Disul	Dezil	Dia Douni	Di-Domhnuich	Domini	Solis
Dydh Lyn	Diliun	De Lin	Dia Luan	Di-Luain		Lunæ
Dydh Maurth	Demeurs	De Merh	Dia Mart	Di-Màirt		Martis
Dydh Merker	Demerker	De Marhar	Dia Keadain	Di-Ciaduin		Mercurii
Dydh Joy	Dirion	De Jeu	Di Ardyn	Diardoin		Jovis
Dydh Guener	Guener	De Guenar	Dia Hyne	Di-Haoine		Veneris
Dydh Sadurn	Dar Sadorn	De Zadarn	Dia Sarn	Di-Sathuirne		Saturni

governed by certain prepositions. But it is not easy, from considering the force of these prepositions, to discover any uniformity of relation in those which govern the same form, by which such forms may be identified with the several cases in other languages.

When two nouns concur in the relation of possession, which in other languages requires a genitive of the noun possessing, no change takes place in Welsh.

In Cornish the genitive is expressed by the preposition 'a,' *of* or *from*; the dative by Dha, *to*, which are prefixed to the article 'an,' and form A'n and Dha'n.

In Armoric, Ens *of* or *from*, and De, *to*, are similarly employed.

In Erse the cases are formed by changing both the initial and final syllables, as in the following specimen, to which the article is prefixed.

	SINGULAR.	PLURAL.
Nom.	An foghmhar	*Nom.* Na foghmhara
Gen.	An fhoghmhair	*Gen.* Na bfoghmhara
Dat.	Do an / Do'n } fhoghmhar	*Dat.* Do na foghmharaibh
Acc.	An foghmhar	*Acc.* No foghmhara
Abl.	Gan fhoghmhar	*Abl.* Gau foghmharaibh

There are many forms of declension, but the termination Ibh in the dative plural is common to all.

Stewart's grammar of the Scoto-Gaelic, at the time of its publication the only philosophical view of any Celtic language, distinguishes between the initial and final variations of nouns. The latter express the relations of case, and seem to depend upon a change of the last *vowel*, which may be considered as the characteristic of case, rather than upon a change of the final *letter*. The initial variations may be divided into, first, those which aspirate the initial letter when a consonant; and secondly, those which articulate it when a vowel, with the prefix of a consonant, preventing the open vowels. The relations expressed by the usage of the primary or aspirated form, are not the same with those of case. A noun is aspirated, if preceded by certain cases of the article, whence arises the initial change in the above specimens of the Irish Gaelic, and also after an adjective and certain prepositions.

COMPARISON OF ADJECTIVES.

The Welsh, Cornish, and Armoric, form the comparative by adding 'ach,' and the superlative, by adding 'af' or 'a' to the positive, thus,

Rhaid, Rheitach, Rheitiaf.

The Erse forms the comparative by prefixing 'nios' to the genitive case of the positive; and the superlative by prefixing 'ro' to the nominative of the positive, thus;

Ard, Nios airde, Ro ard.

In all these, as in most other languages, the adjectives denoting good, bad, great, and little, are irregular in their comparison.

	WELSH.	ERSE.
Good, etc.	Da, Gwell, Gorau	Maith, Nios fear, Ro maith
Bad.	Drwg, Gwaeth, Gwaethaf	Ole, Nios mœsa, Ro ole
Great.	Mawr, Mwy, Mwyaf	Mor, Nios mo, Ro mor
Little.	Bach, Llai, Lleiaf	Beag, Nios luge, Ro beag.

The Cornish and Armoric are nearly similar.

PRONOUNS.

Eng.	*Welsh.*		*Cornish.*		*Armoric.*		*Erse.*		*Scot.-Gael.*		*Manks.*	
	PERS.	POSSESS.	PERS.	POSS.	PERS.	POSS.	PERS.	POSS.	PERS.	POSS.	PERS.	POSS.
I	Mi,Fi	Mau	Mi	Ma	Me	Ma	Me	Mo	Mi	Mo	Me	My
Thou	Ti	Tau	Ty	Da	Oud	Da	Tu	Do	Tu	Do	Oo	Dty
He	Ev	Ei	E	E	En	E	E *or* Se	A	E	A	Eh	E
She	Hi	Ei	Hi	I	Hy	He	I *or* Si	A	I	A	Ee	E
We	Ni	Ein	Ni	Agan	Ny	Hon	In, Sin	Ar	Sin	Ar	Shin	
Ye	Chwi	Eich	Chui	Agyz	Chouy	Ho	Ibh,Sibh	Bur	Sibh	Bhur	Shin	
They	Hwy *or* Hwynt	Eu	Gy	Agei	Ou	O	Iad,Siad	A	Iad	An	Ad	

In Welsh, affixes derived from these pronouns are compounded with the prepositions governing them when in construction. These affixes consist of the radical letter of the pronoun, preceded by a vowel; for instance, Af, Yf, or Of, from Mi or Fi; Oni, Yni, from Ni, etc.

The variation of the initial vowels renders these affixes (as the variation of the initial consonants does nouns) appropriate to the different classes of prepositions.

The following specimen of the declension of a personal pronoun will sufficiently illustrate this.

	Armoric.		*Erse.*	
	SING.	PLUR.	SING.	PLUR.
Nom.	Me	Ni	Me	Inn, Sin
Gen.	Ahanoum	Ahanomp	Mo	Ne
Dat.	D'in	Deomp	Dh'amh	Du' ir' nibh
Acc.	Ma' *or* 'am	Hou	Me	Inne

The Cornish is similar.

VERBS.

1. The radix of verbs appears to be a noun of action or attribute.

2. That radix, by suffering certain changes, receives the additional idea that the action or attribute denoted, is exerted either by or upon the person or thing connected with it in construction; constituting VOICE.

3. Other changes in the radix convey the additional idea of the peculiar mode of action, or MOOD.

4. Others of the time of action, TENSE.

5. Others of the person to whom the action is attributed, PERSON.

In an early state of language, it seems not at all improbable, that each of these additional ideas was expressed by distinct and significant adjuncts, which, in process of time coalescing and becoming confounded with the radix and with each other, formed those inflections by which verbs, in language as it now generally exists, are adapted to the expression of their several ideas and relations, but which, if detached from their verbal radix, have of themselves now no meaning.

Verb Substantive, To be.

Welsh.	*Cornish.*	*Armoric.*	*Erse.*	*Scot.-Gael.*	*Manks.*
I will be					
1. Byd-hav	Bedh-av	Me-am-Bezo	Biad	Bi-mi	Bee'-m
2. Bydh-i	Bedh-i	Te-az-Pezo	Biad-air	Bi-thu	Bee-oo
3. Bydh, *Radical*	Bydh	E-en-Devezo	Biad	Bi-se	Bee eh
PLUR.					
1. Bydh-wn	Bedh-ou	Ny-hon-Bezo	Biad-maid	Bi-sinn	Bee-mayd
2. Bydh-wch	Bedh-oh	Chouy-oz-Pezo	Biad-aid	Bi-sibh	Bee-shiu
3. Bydh-ant	Bedh-anz	Y-o-Devezo	Biad-aid	Bi-siad	Bee-ad

Terminations marking Person and Number.

Welsh.	*Cornish.*	*Armoric.*	*Erse.*	*Scoto-Gaelic.*	*Manks.*
I will love.	I will see	I will love.	I will torment	I will strike	I will lose.
1. Car-av-amh	Guel-av	Me-a-garo	Cesfad	Buailidh mi	Cailleeym
2. Cer-i-ti	Uel-i	Te-a-garo	Cesfair	Buailidh tu	Caillee oo
3. Câr, *Radical*	Uêl	E-a-garo	Cesfaid	Bualidh se	Caillee eh
PLUR.					
1. Car-wn	Guel-un	Ny-a-garo	Cesfamaid	Buailidh sinn	Caillee mayd *or* shin
2. Cer-wch	Guel-o'	Chuy-a-garo	Cesfaide	Buailidh sibh	Caillee shin
3. Car-ant	Guel-anz	Y-a-garo	Cesfaid	Buailidh siad *or* Iad	Caillee ad

To stand; Welsh, Sefyll; Cornish, Sefal; Armoric, Sevel; Erse, Seasum.

Future.

	1.	2.	3.	1.	2.	3.
Welsh.	Savaf	Sevi	Saif	Savwn	Savwch	Savant
Corn.	Savav	Sevi	Sav	Savun	Savo'	Savantz
Armor.	Savin	Savi	Savo	Savimp	Savot	Savint
Erse.	Seasfad	Seasfad tu	Seasfad se	Seasfamaoid	Seasfaid sibh	Seasfaid siad

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We shall conclude these observations upon the philology of the Celtic æra of Britain, with some additional remarks, by way of illustration of the first part of the essay, upon the history of the Celts themselves.

The earlier historians and geographers seem to have possessed but slight and inaccurate information concerning the race and territory of the Celts; nor was it until the time of Cæsar, styled by Tacitus upon such subjects, "summus auctorum divus Julius," that any certain points were considered as perfectly well ascertained, and, even to this day, the concise narrative of Cæsar remains the most important authentic record.

Concerning their name, Cæsar observes, "Ipsorum linguâ *Celtæ,* nostrâ

Galli appellantur;" and the etymology of the term Celtæ, which was thus unknown in Cæsar's day, is at least equally so in our own. The ancients, however, of whom may be cited Pausanias (lib. I. 3), Appian (Bell. Hisp.), and Strabo, seem to have been of opinion that the term Γαλαται, or Galli, was of later origin, and that the more ancient denomination of the people was Celtæ.

There existed also, during the centuries succeeding the middle age, much difference of opinion, as to the people designated by the term Celtæ, and the extent of their territory.

Schoepflin enumerates four opinions upon these points:—*

I. That which considered the term Celtæ as originally comprehending all the European nations.

II. That which confined the term to the ancient inhabitants of Spain, Gaul, Britain, Germany, and Illyria, excluding the people of Italy, and the nations south of the Vistula.

III. That which limited the term more strictly to the Germans and people of Gaul.

IV. That which considered the Germans alone as the primitive Celtæ, and denied the appellation to the Gauls, save as of secondary application.

These opinions have each been supported by a host of learned authorities, but they are all now known to be erroneous.

The Celtic was one only of the great primitive tribes, by which, through the intervention of Persia, Europe is supposed, upon pretty strong grounds, to have been peopled from the East. These have been enumerated as the Celtæ; the Teutones, progenitors of the Gothic, Scandinavian, Saxon, and German nations; the Slavonians, already noticed at length by Dr. Prichard, in our first and second numbers; and the Pelasgians, of whose language the idioms of Greece and, in some degree, of Rome are to be considered as dialects; languages all belonging to a single class, common also to Persia and to India.

We have already seen that the dawn of history exhibits to us Western Europe, with the exception of the Iberian peninsula, as occupied by the Celts or Gauls, and that they existed under the principal, but probably only dialectic distinctions of Celtæ and Belgæ.

Dr. Prichard has shewn that there exists tolerably conclusive evidence in favour of the Celtic origin of the earliest inhabitants of the north of Italy, by whom the cities of Rimini and Ravenna were founded, and who were thence expelled by the maritime colony of the Etruscans.

* Vindiciæ Celticæ, 4to. 1754; a book, the conclusions of which are not indeed always to be relied upon, but which contains very considerable information concerning the Celtic people: to it may be applied the words of its author, concerning the work of Athenæus.—"Repletus est liber, uti constat, vario eruditionis genere, ex multis scriptoribus diligenter congestus, et câ quidem methodo, ut semper scriptoris, unde sumptum est, aliquid nomen adjecerit."

It has also, by the same high authority, been shewn, that there is reason for concluding not only the Umbri, but the Opici or Ausones, the earliest inhabitants of southern Italy, to have been Celtic tribes. Their language, the ancient Oscan, contributed, with the Œnotrian and later dialects of Greece, to form the Latin idiom, in which its traces may still be detected.

The Siceli, the supposed primal population of Sicily, are considered to have been of Opic, and therefore of Celtic, lineage. It should however be stated, that there are some grounds for supposing the Siceli to have been superimposed upon a still more ancient Iberian colony.

We have, therefore, traces of a primal Celtic population throughout Italy, and possibly Sicily, succeeded by, and more or less mixed with, at an early period, Grecian or Pelasgic colonists. Gaul, however, appears to have been, from a very remote period, the fruitful centre of the Celtic population of Europe. On the north, her tribes peopled by successive waves of emigration the yet uninhabited islands of Britain: on the west, they crossed the Pyrhenean chain to form the Celt-Iberian nation: on the north-east, the Germans of the lower Rhine, a people at least as warlike as themselves, seem to have limited them to that natural boundary. But their chief excursions were in a different direction.

It appears from Livy, that Sigovesus and Bellovesus, Gaulic chiefs, led forth numerous bands from the thickly peopled regions of Gaul, to take possession of other lands.

Bellovesus crossed the Alps B.C. 590, and driving forth the Etruscan inhabitants, became possessed of the circumpadane territory, excepting Mantua. His colony and their descendants, under the names of Cenomani and Salivii, remained on the north, as Boii, Senones, and Lingones, on the south, of the Po; and as the Laii, Lebecii, and Insubres, and probably the Venetii, are enumerated by Polybius as existing in Italy.

The Senones occupied Rome U.C. 364, and were destroyed by the Romans, according to Polybius, U.C. 463. The Boii are said by Strabo to have been ejected from Italy, and to have migrated along the course of the Danube, until exterminated by the Daci. Mediolanum, Comum, Brixia, Verona, Vicentia, Vergamum, and Tridentum, are all cities whose foundation has been attributed to the descendants of this Bellovesian colony.

Sigovesus, at the head of the other colonists, marched into the Hercynian forest, and founded tribes who extended themselves along the Danube, and who, passing through Pannonia, Greece, Macedon, Thrace, and Asia Minor, finally extended themselves into Asia Proper, and, having obtained permission from Nicomedes, king of Bithynia, founded the flourishing kingdom of Gal-atia.

Besides these two principal colonies, should be mentioned also the Arecomici and Tecto-sages, Volscian tribes, who occupied the Deltas of the Rhone and Narbonese Gaul; the Helvetii, whose name (literally Up-hill-men) is a sufficient evidence of their Celtic origin; and the Boii, akin

probably to the Boii of Cisalpine Gaul; who extended themselves, the Helvetii into Switzerland, and the Boii into Norica, where they founded the clearly Celtic cities of Boio-durum and Arto-Briga.

Such then were the Celts: a nation whose origin, long concealed and mystified by those who professed to illustrate it, is now attributed upon almost irrefragable evidence to the primal inhabitants of India, and whose language does not appear to be second in antiquity even to the Hebrew itself—a people, who, neither tainted by the enervating luxury of the one, nor suffering under the moral incapacity which the divine displeasure seems to have inflicted upon the other branch of the great patriarchal family of nations, burst forth like the sand of the sea shore for multitude, and rendering themselves successively formidable to the inhabitants of east, west, and north, marched from the banks of the Indus to those of the Tibur, and struck terror into the hearts of the Romans themselves.

But the empire which their valour had won, the political sagacity of the Celts was not competent to maintain. Disunion among themselves, and the disciplined valour of their enemies, seem to have been the efficient causes of their decay, and of their almost general extirpation. Such at least was the fate of the Celtic inhabitants of the plains, but wherever the discipline of their enemies was rendered useless by the rugged nature of the country, there they made a final and successful stand, and there they preserved their language and nationality, unshaken by the storms of Roman, Saxon, and Norman tyranny, until the bright beams of Christian civilisation, by gradually converting bordering enemies into fellow-citizens and friends, insured to them the enjoyment in peace of the independence which they had so well maintained in war.

Of the character of the Celtæ of remote antiquity, we have no means of becoming exactly informed; and even were such means extant, it would be obviously unfair to apply any conclusions arrived at from them, without also estimating, under similar circumstances, the character of other nations. But if, from the remnant of the Celtic nation, still preserved along the western shores of Great Britain and the mountains of Armorica, any just conclusion can be drawn respecting the general Celtic character, that conclusion will assuredly be a bright one. It must be admitted that they are faithful to their religion, zealously attached to their country, loyal to their monarchs, and severely jealous of their personal and political liberties; and if, on the one hand, they possess not some of those valuable acquisitions in science and literature, which have been attained under far more favourable circumstances by their Saxon or Norman neighbours, they boast, on the other, a more ancient language and literature of their own, and bards whose compositions, for vigour of conception and felicity of expression, will not suffer from comparison with many far later poets of Anglo-Saxon or Norman lineage.

The language, the dialects of which we have in this essay been attempt-

ing, however imperfectly, to compare, had gradually, until a few years back, been falling into decay; since that period, however, the people of the principality, and more especially of "Gwent," have made vigorous and well directed efforts, to wipe away this national disgrace.

The individual, even of Norman lineage, is scarcely to be envied, who can witness with apathy the proceedings at one of their national meetings or Cymreigyddion; nor does it follow that because his opinion upon some points connected with the progress of the Welsh language may not coincide with those of the enthusiastic native, that they should not in the main agree heartily.

Ai un hynt gwynt: ai un dwfr mor:
Ai un ufel tan, twrwf diachor!

The hospitality of the ancient Cwmri has long been recorded; and, in this respect at least, their living representatives will scarcely be thought to have degenerated. Many a stranger, who has perhaps little else to recommend him, will bear witness that the Croesaw of the Cwmri, whether to their domestic halls, or their Cymreigyddion and Eistedfodau is bestowed with a warmth calculated to disarm that criticism which it might indeed securely defy.

Note A.

The following geographical names, selected from a very much longer list, may be taken in evidence of the ancient extent of the Celtic territory in continental Europe. Whatever difference of opinion may exist concerning the *precise* signification of many of these names, they are all nevertheless Celtic. It may be observed here, once for all, that by *Celtic* we mean, unless the contrary be evident, the general Celtic nation, and not the Celtæ mentioned by Cæsar as occupying one division of Gaul.

The Latin names, where they are known, should be looked to, as exhibiting a Celtic origin more evidently than those of the corrupted form of the modern language of the country.

If the reader will be at the pains of comparing this list with those that follow of British names, he will at once see their general resemblance.

Mountains.	Aigue	Aube, *Bir, water*
Alps, Alpen, *Pen, a head*	Agache	Auge
Apennine	Achasse	Aude
Cevennes, *Cefn, a crest*	Arne	Adige
Cantal, *Can, white*	Arno	Allier
Penalara	Arve	Aron
Pennas	Nar	Cam, *tortuous*
——	Var	Doure, *Dûr, water*
Rivers.	Aven, *Avon, river*	Douro
Aa	Avance	Adour
Aar	Avencon	Adar
Aache	Amance	Durance
Aiche	Avignon, *rivulet*	Tour

Touer	Loire, Liger	Saone
Doubs	Marne, Matrona	Seine, Sequana
Esla	Meuse, Mosa	Somme, Saonara
Garomne, *Gawr, swift*	Nantz, *Nant, brook*	Tagus, *Taffe, rapid*
Iser	Neckar	Tamaine
L'yonne, Icuana	Rhine, Rhen	Vienne
Oise, Iscara, *Uisge, water*	Rhone, Rhodanus	Vannes
Ousche, Oscara, *Oiche, water*	Scheldt, Iscaldis, *Snuadh, river*	Orvannes
		Vene

Note B.

Any thing like a regular list of the examples from whence the above conclusions are drawn, would of course be out of the question. But we annex a few.

Mountains, etc.	Pendle	Churne
Ben Nevis	Penistou	Lix
Ben More	Sliabh sneacht, *snow mountain*	Clyde
Bread-al-bane, *the region of lofty hills*	Wokey, ogof, *cave*	Ely, *Avon-lai*
Cairn Gormn	Porth ogof, *gate of the cave*	Even lode, *Avon lhyd*
Can More, *great head*		Dee
Cader Idris, *the strong-hold of Idris*	*Rivers.*	Dur
		Derwent
Carrey-y-ogof, *the craig of caverns*	Aled	Du-glas
	Alen	Severn
Garth, *a concave promontory*	Alon	Esg, Esk } *Uisg*
	Arrow	Stour
Malvern, *the high seat*	Aune	Taffe
Moel-y-golfa	Avon	Tame
Mendip, *dark stone*	Ax	Tay
Ochil, *lofty*	Axe	
Pen-y-gent	Cam	

and a multitude of Tamars, Avons, and the like.

Islands and isolated places, where they have received Celtic names, usually retain them. Ynis, in Welsh; Inch, Insh, Ince, Ennis, in Erse, signify an island.

The territorial divisions of the Britons were diminished, or otherwise altered, by those who came after them; and as new divisions required new names, the great proportion of such names are not Celtic. In some cases, however, the name has been retained, although the extent of territory included under it has been curtailed. Thus we have

English.	*Latin.*	*Celtic.*
Cornwall	Cunovallus	Kynvael
Devon	Damnonia	Danmonith
Dorset		Dwrgwr
Kent		Cant
Strath Clyde		

For the preservation of the Celtic names of towns, as well as of other objects, we are indebted in many cases to the Latin; and where the etymology of the modern form of a name is obscure, the Latin form usually will elucidate it.

Thus Uisk or Uisg, *water*, the Latins preserved as Isca, but the Saxons seem to

have altered into Acs or Acsc, Eacs or Eax, Ox, or Ux; hence we have Acemannes Cester, city of Bath; Acsanminster, Axminster; Exceaster, Exeter; Exanmuth, Exmouth; Oxnaford, Oxford; Uxbridge, etc.

Alcester	Alauna	Exeter	Isca
Burchester	Vinovium	Gloucester	Glevum
Bere	Iberium	Ilchester	Ischalis
Bangor	Banchorium	London	Londin
Cambridge	Camboritum	Lincoln	Lindum
Caerwent	Venta Silurum	Manchester	Mancunium
Catterick	Cattaractonis	Neath	Nidum
Caermarthen	Maridunum	Reculver	Regulbium
Dorchester	Durnovaria	Winchester	Venta Belgarum, etc.
Dover	Dubris		

The Romans also retained the names of many of the old roads: such are Ryckield Street, Ermyn Street, Ikeman Street.

We annex a few of the most common Celtic geographical names or parts of names. Hên, *old;* Maes, *a plain;* Pen, *a head;* Din or Tin, *a fortified mount.* Thus Dinbren in Denbigh, Tin Sylny and Tin Æthny in Anglesey, are townships containing fortified hills. The word is now obsolete, but it seems to be of similar origin with, or possibly to have given rise to, the Latin Dinum, Dunum, Dinium, so common over Gaul and Britain, and the Welsh 'Dinas,' a city or fortress. Ychel-dhin, axelodunum, Bryn-dhin, Brannodunum, Kam-dhyn, Cambo-dunum.

Dhu, *black;* Bri, Bre, Vre, *a hill;* Rhyn, *a promontory;* Ard, *high;* hence, probably, Garth, Harlech or Ard-lech, *high rock;* Drim, *a back;* hence Trim or Drim, *a ridge;* Traeth, *a sandy shore covered at high water;* Tal, *a front;* Blaen, *the head of a combe;* Sarn, *a causeway;* Coed, *a wood;* Dol, *a holme;* Llan, *a level spot;* used secondarily in Welsh for *a church;* Llyn, *a grove.*

Out of 45 parishes in Great Britain, whose names commence with Hen, 32 are in England, 13 in Wales, including Monmouth and Hereford. Bod, 8 in England, 9 in Wales. Tal, 7 in England, 71 in Wales. Aber, 2 in Yorkshire, 20 in Wales, 14 in Scotland. Pen, 52 Wales, 5 Scotland, 41 England. Llan, 2 Salop, 431 Wales. Eglwys, 7 Wales. Ac or Ak, 31 England, 2 Wales. Bettws, 3 England, 13 Wales. Kir, 52 Yorkshire, 8 Westmoreland, 9 Northumberland, 12 Cumberland, 29 rest of England, 33 Scotland. Most of the southern names commence with Kir; those of the north with Kirk. Kil, 37 England, 52 Scotland, 9 Wales.

The mountains, lakes, rivers, counties, villages, towns, churches, in Ireland, are for the most part Celtic. Some are English, such as Lanesborough, Hillsborough, Newtown, Newcastle; some mixed, as Lifford, Banfoot, Abbey-feal.

The terminations 'ey' for island, and 'ster,' Ul-ster, are said to be Scandinavian.

Chalmers states that out of 3,842 topographical names in Ireland, 3,028 are Gaelic, 171 mixed, 623 English, and 20, chiefly of border lands or islands, Scandinavian.

In the isle of Anglesey, there are 82 ecclesiastical divisions, rectories, vicaridges, and chapelries; of these the names of 79 are pure Celtic, of 2 English, and of 1 barbarous Latin. Of the Celtic, however, very many are evidently modern, as they are composed of Llan, *church*, with usually the name of the patron saint as an adjunct. In one case Eglwys is used as a termination.

The two English names are Newborough and Holyhead. The one Latin-French is Beaumaris, the church of which is dedicated to the "blessed Mary."

The prefix Llan occurs 66 times. In 56 cases the name of the patron saint is the adjunct. In composition Mary becomes Vair, Var, Varn; Michael, Hangel, or "the angel;" Patric, Badric; Peter, Bedar, etc.

Celtic names of persons are such as Caradoc or Cradock, dearly beloved; Enion, upright; Gryffith, strong-faithed; Madoc, good; Morgan, Pelagius, sea-born; Tudwr, from Theodore; Don, Garth, Glyn, Glennie, Pen, Goffe or Smith, Ap Rice or Price, etc.

Note C.

There are, indeed, certain words in use of Celtic origin, which from having been only local terms, have by degrees become more or less incorporated into the English language. Such are Peel, *a fortalice;* Pill, *a creek;* Cwm *or* Combe, *a valley in the side of a hill;* Eyrie, *the nesting place of an eagle;* Keyvelin, *skilful;* Snood, *a head-band;* Mail, *tribute;* Siker, *sure;*—the Kirkpatrick motto is, "I make sicker;" Brock, *a badger;* Spense, *a buttery.* Glen, Bard, Bog, and many others might be mentioned, sufficiently familiar to the readers of Scott and the Scottish poets.

It does not, however, appear that any decidedly Celtic word can be discovered in classical or ordinary colloquial English; and the same may perhaps be affirmed, and from a similar cause, of the French language; though it is indeed far more probable that the Celtic should have entered into its composition.

The proportion of Celtic in modern languages was a point upon which much ignorance formerly existed; Bullet, for example, in his elaborate "Dict. de la Langue Celtique," published in the last century, cites the following treaty, entered into A. D. 842, by Charles le Chauve, king of France, and Louis, king of Germany, as a proof of the extent to which Celtic prevailed in French. The words in Italics are cited by him as Celtic.

"Pro Deo *amur*, et pro Christian *poblo*, et nostro *commun saluament*, *dist in avant*, in quant Deus *sauvir* et *podir* me *dunat, si *saluari* io cist meon fradre Karlo, et in adjudha, et in *cadhuna cosa*, si com, †om per *droit* son fradre *salvar*, dist in o quid il mi altre si fazet, et ab Ludhei nul *plaid* nunquam *prendray*. Qui meon vol cist meon fradre Karle in damno sit."

It was at that time a rule with Bullet and many others, if a word could be derived both from the Latin and the Celtic, to take the latter etymology, the reverse of which now obtains.

There is in the City Library an old copy of "Cambry, sur les Monumens Celtique," and in its fly-leaf some discerning friend, to whom the author had presented it, has written the following observation, which might have been much more widely applied. "Je ne connois point de livre où l'on ait prodigué autant les conjectures les plus hasardèes. J'en suis faché pour l'auteur qui est un galant homme, et un homme de beaucoup d'esprit."

* Donnera. † Homme.

OBSERVATIONS ON ENGLISH CASTLES.

It required no great advance in civilisation, to discover that a circumvallation of earth and stakes was the shortest and a sufficiently good way of defending any particular spot; and that it was advantageous to dispose the excavation from whence the earth was drawn, in the form of a ditch on the exterior of the mound. Such is the rudest method of fortification, and of such works numerous instances may be seen in our immediate neighbourhood. The spot chosen was generally the summit of a hill, and the figure of the intrenchment depended usually upon the disposition of the ground. Such works were strengthened by the addition of two or more ditches and banks, where the hill was not sufficiently steep, and the

entrance, winding up from below, passed through the defences, sometimes at right angles to them, at others obliquely. It has been supposed that entrances of the latter kind indicate a period subsequent to those of the former.

At a period certainly more advanced, the bank was not considered as a sufficient security, and upon it a wall, regularly constructed with stones and mortar, was erected. The remains of such a wall may be seen on the opposite camps of the Bower-walls and Clifton Down.

It has been conjectured that this method was adopted by the Romans, by whom the British intrenchments were occasionally occupied, and who styled the ditch, mound, and wall, the *fossa*, *agger*, and *vallum*.

The Celtic intrenchments are in almost every case on the top of a hill, and of an irregular figure. Some authors have supposed that latterly they adopted a more symmetrical form, but this does not appear to be an established fact.

As civilisation advanced, and war assumed the features of a regular science, it became evident that the labour of transporting heavy baggage, water, and provisions, to the summit of a hill, was but a poor compensation for the advantage of a look out. The camps, therefore, of the Romans were generally on a plain, and deserved the name rather of encampments than intrenchments. They were laid out according to the rules of castrametation, and were usually quadrangular, with openings at the sides. They were defended by an *agger* and a *fossa*. A very fair specimen of a Roman camp may be seen in a field, north of the church and the Bath road, at Bitton.

But this method, though suited to the purposes of a hasty defence, without any very great inequality of number between the defending and attacking forces, was too insecure for the residence of a small and permanent garrison; and hence the distinction between *field* and *permanent* fortification, between defences intended to withstand only a sudden attack, the party within being strong and constantly on the alert, and those behind which a limited garrison might stand even a protracted assault, or dwell in tolerable security.

The earliest permanent fortification, after the trench and bank which we learn from Tacitus to have surrounded the German and Celtic cities, appears to have been a quadrangular or circular wall of stones, rudely built, and cemented with an inferior kind of mortar; such were *probably* the strong-holds mentioned in the early history of Wales, traces of which are still found, and which seem to have been erected intermediately between the early intrenchments and the later Norman castles.

But a very limited experience would teach the defenders of such a place, that the number of weapons, capable of being brought to defend any particular point, whether of a circle or a quadrangle, was small; and that those who wielded them would be exposed to considerable danger, unless by some contrivance the exterior base of one wall could be seen from the

interior summit of another. Hence the introduction, at an early period in the history of the world, of towers, disposed at regular intervals along the walls, by which not only did the wall itself receive an accession of strength, but the defenders obtained a number of *salient* points, whence they could *enfilade,* or direct their weapons along the face of the intermediate or *curtain* wall. By this means the curtain, or that part of the line of defence least capable of withstanding the strokes of the ram, became that best capable of being defended by missiles; while the towers, which had not the advantage of being thus *flanked,* were, from their circular form and solid material, in but little danger of destruction. If therefore we suppose a square, or still better a polygon, to be fortified with towers at its angles, it is evident that the exterior of each curtain wall, midway between its flanking towers, will be the points upon which most weapons admit of being directed, and that the points on the exterior of each flanking tower, midway from its containing curtains, will on the contrary be those upon which fewest missiles can be directed; or, in other words, that if from the centre of the place we draw straight lines, passing through each of its angles, and midway through each of its sides, the prolongations of the former lines will be the safest, and those of the latter the most exposed, directions in which an enemy can approach.

Lines drawn from the centre of a place, through its salient angles, are called capitals; they are the lines of approach at present employed.

It does not, however, appear that the system of approach by capitals was at all understood before the introduction of artillery.

The old system of fortification, by curtains and angular or intermediate mural towers, seems to have been in use both among the Greeks and Romans, and by them to have been found or perhaps introduced into many parts of Asia, as it certainly was into Gaul and Britain.

But this system reached its perfection under the Norman monarchs of England, whose castles, before the introduction of gunpowder, were fortified with a mixture of rude strength and ingenuity, the remains of which still command our admiration. We shall, in illustration of our subject, bestow a page or two upon the history and description of these structures.

The etymology of the Latin word *castrum,* whence our term 'castle' is derived, was said by Julius Feretus to be *castè,* chastely, 'quia ibi omnes *castè* vivere debent.' However just this etymology might have appeared to honest Julius, certainly history has very much belied the inhabitants of our English 'castra,' if the '*castè*' applied in any degree to them.

It is now an established fact, that, with the exception of the Roman castra, before the Norman conquest there were few or no castles deserving that name in Britain, a sufficient reason for the rapidity with which William over-ran the whole kingdom, the complete subjugation of which he could scarcely have so suddenly atchieved, had many of those strongholds existed, whose ruins have descended to our own time.

But if William found no castles erected to oppose his progress, he seems to have determined that no future invader should be able to make the same remark. He himself laid the foundation of a large number of edifices, and in the reign of Stephen, owing to the turbulent state of the country, and the increasing power of the grand feudatories of the crown, their sum, according to an authority cited by Grose, had increased to 1115, a prodigious number.

Each of these castles, as the feudal system gathered force, became the centre of a barony, and the residence of some turbulent baron, who exercised a severe, because undefined and often usurped, authority, over his wretched vassals. To such a pitch had this baronial insolence risen, and such were the scenes carried on in their castles, that they are called by a contemporary writer, "nests of devils, dens of thieves." Every man of baronial, and many of knightly rank, possessed one or more castles, from whence he could sally forth, and lay his neighbour's lands under contribution. The lords spiritual had also their castles; and, to judge from the behaviour of some of them, they were rather worse than better than those of their temporal brethren.

But this evil in some measure corrected itself, for by a treaty between Stephen and Henry duke of Normandy, all castles erected within a certain period were rased, and Henry on his accession to the English throne destroyed many more, and finally established the licence to build them as a part of the regal prerogative. Such a permission was called "Licentia crenellare," and continued to be sought after for some centuries.

The castles of the crown were held by some trustworthy castellan, and were garrisoned by the immediate retainers of the monarch. Grants of estates were not unfrequently made to individuals, on condition of their performing annually so many days' castle guard; and occasionally the tenure bound them to repair some particular tower or bulwark, as at Dover. Nor was this prerogative confined to the crown; the twelve paladins of Glamorgan held their estates on condition of defending Fitzhamon's castle of Cardiff, and at Belvoir is still a tower repaired by the ancient family of Stanton, whose representative, not very many years since, attended at Belvoir, nominally for that purpose. Castle guard tenure was usually, in after times, commuted for a sum of money; and, after having been limited by Henry the eighth, was finally swept away with the whole vexatious system of feudal tenures, by the celebrated act of the 12th of Charles the second.

As the country became by degrees more peaceful, structures devised solely with a view to military purposes, and with very little or none to comfort, became irksome and uninhabitable dwellings. The owners either altered them, or suffered them to fall into decay, or pulled them down and erected modern houses out of the materials. The discovery of gunpowder, and the introduction of a totally new system of defence, rendered even

those structures that had escaped mutilation still further useless as military works. They were converted usually into prisons or store-houses, to which ignoble uses we owe the preservation of very many of them.

Charles the first, in the year 1636, a little before the breaking out of the great civil war, appointed, at the instance of the earl of Strafford, a commission to examine into and report upon the state of the English castles. At this period, probably in consequence of this report, many of these buildings were defended by earth-works, according to the modern system; and when taken or deserted were completely dismantled, and in most cases blown up with gunpowder.

Although the weapons employed in attack and defence do not appear to have undergone much change during the feudal period, yet as the general arrangement of the defences varied at different periods, it will be proper to point out the most remarkable of those changes, a synoptical view of which is offered in the accompanying table.

Military Antiquities.

- ROMAN
  - Quadrangular — Burgh, Richborough, Portchester.
  - Multangular — Pevensey.
- NORMAN
  - Circular ....
    - *Detached.* Brunless ?
    - *Keep Central.* Launceston, Skinfrith.
    - *Marginal.* Coningsborough.
  - Quadrangular
    - *Central.* Dover, London, Rochester, Corfe.
    - *Marginal.* Portchester (Norman alterations), Kenilworth, Castleton, Ogmore, Goodrich, Chepstow.
  - Multangular
    - *Keep on a level.* Chilham, Orford.
    - *Keep on a mound.* Cardiff, Crickhowel, Warwick.
- GOTHIC
  - Concentric ..
    - *Quadrangular.* Caerphilly, Harlech.
    - *Longitudinal.* Conway, Chepstow, Caernarvon, Morlais, Dinas near Talgarth.
    - *Multangular.* Hawarden, Holt.
    - *Irregular.* Framlingham.
  - Single .....
    - *Early.* Neath, Newport, Monmouth.
    - *Later.* Coity, Walton, Thornbury, St. Donat's.
  - Mixed .....
    - *Domestic Castles.* Hever.
    - *Castellated Mansions.* Nether Hall, Lullingston, Broughton.
    - *Block Houses.* Walmer, Deal, Calshot, Hurst, Sandown, Sandgate, Carlisle, Camber.

The castles erected by the Conqueror appear to have been built for the most part after one model. A square or oblong keep, two or sometimes three squares in height, strengthened along the sides and at the angles by pilaster strips of very slight projection, and usually dying into the wall below its summit. The entrance to such keeps is on the first story, that floor only being vaulted. Where these keeps are large, as at Rochester and Portchester, they are divided into two unequal parts by a wall; and the exterior walls are perforated by triforial galleries, accessible by a well staircase at one of the angles. The pipe of the well is also often carried down in the thickness of the wall. The windows are small, excepting at the summit, or towards the court; the fire-places large, and provided with regular flues. These structures, the details of some of which are highly ornamental, continued to be erected for about a century after the conquest; and, from their great strength and solidity, continued to give the distinguishing feature to the works, through all subsequent alterations.

Besides these keeps, the Norman castles were defended by outer walls, of the circle of which they sometimes form a part; but such walls, and other subordinate defences, have in most cases been destroyed or materially altered.

The early keeps were not all quadrangular: some, as Cardiff and Oxford, were polygonal; and others, as Launceston and Coningsborough, circular or nearly so.

Many of the Norman keeps, and especially of the circular and polygonal ones, are placed upon artificial mounds. It is at present uncertain, whether these mounds were thrown up by the Norman engineer, or only adopted by him where previously existing. Of course, one round hill of earth is pretty much like another; but there remain in various parts of England, as at Silbury, Marlborough, Brinklow, and other places, mounds about the same size and figure with many of those above referred to; and some of which, as Brinklow, are evidently ante-Roman, from the diversion of the Roman road at the place.

During the twelfth and thirteenth centuries the method of fortification underwent considerable alterations, the general tendency of which was to œconomise men and material, by a more scientific disposition of the line of wall. More attention also was paid to the marshalling of armies in the field, and rather less to the enabling castles to stand a siege by their purely passive resistance.

These changes assumed a determinate form under the superintendence of Edward the first, whose powerful mind had been directed to the subject, under the peculiar advantages of a protracted residence in foreign countries. In the Edwardian castles the keep is no longer a lump of masonry, but becomes, as the anatomist would say, developed, into an open quadrangle, defended at the angles and sides by towers and gate-houses; and having the state apartments arranged along one side of the court. The name of

keep is dropped, as no longer applicable, and around this "inner ballie" two or three lines of defence are disposed concentrically. Such castles inclose frequently many acres of ground, and are remarkable for the height of their towers, and grandeur of their gate-houses; though in solidity and consequent durability their walls are far inferior to those of the pure Norman structures.

The Norman and Edwardian, the solid and concentric, may be considered as the two great types of English castles, of which all other fortified buildings are only modifications. The introduction of artillery, by rendering a lofty wall an inconvenience instead of a safeguard, and by rendering all kinds of architectural defences very nearly equally ineffectual, permitted the introduction of a style of edifice making no pretensions to withstand artillery; and in which the lofty turrets and embattled gate-ways of an ancient castle were combined with the exposed roof and spacious windows of a modern mansion, possessing no doubt many merits, though not the theological one of congruity.

It is not easy to devise a significant appellation for the species of castle that occupied the intermediate stage between the regular concentric of Edward, and the castellated mansion of the Tudors. Such castles were not generally concentric, nor did they contain any tower deserving the name of keep. They are generally of an irregular plan, with a gate-house and a number of mural and flanking towers; and display not unfrequently a profusion of heraldic and architectural decoration. Perhaps the term perpendicular, which has been applied already to ecclesiastical edifices of contemporary date, is on that account as unexceptionable as any.

We shall next consider briefly certain of the most remarkable details of castles of one or the other type.

The parts which seem to have been considered as components of every permanent Norman fortification, were, the *keep;* the *walls of the enceinte,* single, double, or triple; the *ballia,* or courts contained within them; the *gate-way,* usually defended by a regular work or *gate-house; posterns,* or entrances of smaller size; a *fosse,* or ditch without the walls, and in some cases also between them; and opposite to the gate-way, upon the counter-scarp of the moat, an outwork or *barbican.*

The keep was always a lofty structure, variable in figure and position, but usually quadrangular, polygonal, or circular; and placed on the highest ground, commonly near the centre of the castle. When round, keeps were called Julliets, from an erroneous notion that they were erected by Julius Cæsar, to whose credit was usually placed the erection of all massy unclaimed structures, just as to that of Cromwell was in later days their destruction.

The keep and inner ballia contained the state apartments, council chambers, governor's residence, and sometimes a chapel. Any remarkable tower was called a *donjon,* and hence our term dungeon, as applied to places

of confinement; the lower stories of such towers being frequently appropriated to such a purpose.

The walls, when above a single line, were arranged concentrically, those within being either loftier, or on higher ground than the exterior, over the summits of which their engines were intended to play. These walls were composed of *mural*, or towers flush with the exterior face of the wall, and *flanking*, or towers with a projection. They varied in height from twenty to thirty, or even forty feet, and were surmounted by a battlement. The towers, the figure of which was extremely variable, varied also in height and thickness, according to the nature of the ground on which they stood, or the assaults to which they were liable to be exposed. They usually were ascended by a well stair, from whence doors communicated with the battlements on each side, leaving an uninterrupted walk round the walls. Their height above the battlement was rarely above two stories, sometimes, but not often, vaulted.

The *ballia*, or courts between the walls, contained lodgings for the soldiery, pasture ground for the horses and cattle, wells, chapels, and sometimes, as at Portchester, a whole monastery; and here also mounds of earth, or *cavaliers*, were occasionally thrown up to command an outlook, or to support some military engine.

The communication between the ballia and the exterior was carried on by means of gate-ways, usually strong points, and with their gate-houses capable of being completely isolated. Many of these buildings still remain to attest the skill of their architect, and the magnificence of his employer, when the remainder of the structure has mouldered into decay.

A *gate-house* consisted of an arch or portal, two flanking towers, and a drawbridge. The arch was usually about nine feet wide, by ten or fifteen high, with a depth of from twenty to thirty. In front was its pont levis, or drawbridge; then a deep groove for the portcullis; then, perhaps, four or five holes in the vault for the timbers of a stockade; then a second or even a third portcullis; and sometimes a gate or two at intervals. Between each of these defences there was more or less space, so that to guard against surprise, the suspected comers could be partially admitted, and made to tell their errand. One or two loop-holes commanded the portal from either side; and on the outside, exactly over the drawbridge, was often a machicolation, or contrivance by which the besieged could cast down missiles upon the assailants, without being themselves exposed to danger.

The drawbridge is a very ancient contrivance, but it does not appear that the early Anglo-Norman architects were acquainted with the portcullis.

The magnificence bestowed upon the principal entrances was not extended to the posterns, which were commonly arched doors in the wall, of small dimensions, and of sufficient strength to guard against surprise. In large castles, however, the posterns were on a larger scale, and admitted

of the exit of cavalry. Sometimes they opened upon the moat, and communicated with the exterior of the place by a boat.

The fosse or ditch was extremely variable in breadth and depth. Those of castles placed upon eminences, as at Chepstow and Morlais, were entirely dry; but when practicable, a wet ditch was preferred; and this end was sometimes gained by damming up a brook, causing its waters to surround the castle in the form of a lake. In such cases, when time or violence has destroyed the dam, the waters of the lake are evacuated, and the brook returns to its pristine channel, leaving the bed of the inundation, either a plain of green sward, as at Caerphilly, or a dismal swamp, as at Kenilworth.

Of the barbican less is known than of any other part of the castle; and yet it must evidently have been considered as a very important outwork, since it covered the drawbridge, being placed on the glacis of the fosse, exactly opposite the principal entrance. This obscurity may have arisen from the barbican having been usually of wood; so that although strong enough to admit of the annoyance of the enemy while making his approaches, it might be fired and deserted when no longer tenable. Barbicans, however, as appears from a writ of Edward the second, were occasionally of stone; and indeed it is said that that of Framlingham castle still remains. A tax called 'barbicanage' was sometimes levied upon particular lands, for the repair or re-erection of this structure.

The well, though now often choaked up, must always have existed in every castle, not at least partially surrounded by running water. The position of the well is variable. In Coningsborough it is in the centre of the keep. In Rochester, Kenilworth, and Portchester, in the walls. In other castles it is in the inner ballium. At Morlais there appears to have been no well, but instead of it a prodigious excavation in the limestone rock, twenty-five feet square, and though more or less filled up, still seventy-five feet deep. This seems to have been a tank for the preservation of rain water; at least, had it been a regular well, it must have been ninety or one hundred feet deep at the least; and why should it have been so large? Indications of a similar, though smaller excavation occur at Dinas, near Tretower, Brecon.

Besides these are certain subordinate parts which we shall next describe. Of these the principal are the *battlements*. The wall, usually about six feet thick at its summit, is there divided into three parts; the first, or that fronting the enemy, consists of a prolongation of the outer face of the wall, by which those who stood behind it were protected from missiles: this is called the *parapet*. Behind this is the flat top of the wall, forming the *rampart walk;* and behind this is an elevation similar to the first, formed by the posterior face of the wall to prevent the soldiers from falling backwards, the *rere wall*. In some cases, as at Warwick, the rere wall is wanting. The parapet, in the case supposed, would be about six feet high

and two thick; the rere wall the same height, and a foot and a half thick; and the walk two and a half wide. The parapet was rarely an unbroken line of wall, but was commonly cut away at intervals into embrasures, the intermediate masses of wall being called *merlons*. The edges of the embrasures and summits of the merlons were sometimes surmounted by a stone coping, the bead of which was placed so as to intercept any arrow that might strike it; and upon the merlons at Chepstow and Alnwick, stone figures of soldiers are placed. The merlon was sometimes solid, but more frequently pierced by a simple or cruciform loop, the limbs of which terminated in circles called *oillets*.

Sometimes, as over gate-ways, or upon the summits of towers, primarily with a view to the direct annoyance of the enemy, and secondarily to widen the rampart walk, a device called a *machicolation* was employed. Upon the summit of the wall, from its exterior face, projected a row of corbels or brackets, upon which the parapet, advanced by one or even two feet was placed; and thus a series of square holes were formed, from whence any person below might be securely annoyed. This contrivance adds much to the general effect of a tower, as may be seen at Warwick, Raglan, or Thornbury. In false machicolations the parapet is not advanced above half its own thickness, so that there are no holes.

Contrary to what obtains in modern fortification, the art of attacking these castles was inferior to that employed in their defence.

The machines in use much resembled those of the Greeks and Romans; and the reader of Cæsar or Polybius will be able to form a very tolerable idea of a Gothic siege.

The balista, catapulta, and mangonel, constituted the chief of their engines of artillery, by the aid of which stones of a very large size were projected, some of which are occasionally picked up about old castles; and now and then they threw dead carcases of animals, and according to Froissart, upon one occasion, a living prisoner.

With moveable towers and rams they were also familiar, and with the use of the Greek fire.

Mines were sprung by pulling away the props with ropes. Woolsacks were also sometimes suspended from the wall, to deaden the strokes of the ram. Upon the exterior of the gate-house at Warwick, there still remain certain large hooks, said to have been placed there for that purpose.

The cross-bow was a principal weapon, as being more easily worked, and with less exposure of the person, than the long bow. This weapon was anathematized in 1139, by the second Lateran council, as hateful to God, and unfit for the use of Christians. Richard the first reintroduced them into general use, and was, singularly enough, slain by an arrow from one of them.

The materials of which castles are constructed, are generally the stones

nearest at hand; though the angles and battlements are often capped with oolite or mountain limestone, brought from a distance. The mortar employed is usually good; but the peculiar qualities of ancient mortars is a subject still open to inquiry.

At present little is known concerning the uses of particular apartments in castles, or of the domestic life of their inhabitants. It seems probable, however, that a good deal both of new and very entertaining matter upon these and similar points, might be gleaned from the English, and more especially from the French chronicles and fabliaux. The following extract, quoted at second-hand through the medium of the "Child's History of Switzerland," from "Les Chateaux Suisses, par Madame Montolieu," appears to us worth transcription. "The description of a [Swiss] castle, such as formed the residence of most of the nobles, though some few were on a more magnificent scale, will convey an idea of their manner of living about the eighth or ninth centuries.

"It consisted generally of a simple square tower of stone, built on a steep rock, and surrounded by a deep trench. There was no entrance from without to the ground-floor, which contained a dungeon for criminals, a well, and cellars, amply stored with provisions, but scantily provided with wine, a luxury rare in Helvetia, till a much later period. The entrance to the castle was into the first story, at the height of fifteen feet from the ground, by wooden steps which could be drawn up in times of war. This contained the kitchen, through which it was necessary to pass to the other apartments: the female servants had beds inclosed in closets round its sides. A spiral staircase from this led to the second story, which was the apartment of the family; and near the entrance was a large stove of hewn stone, with steps round it, that served as seats. On the other side of the entrance was the state bed of the lord and his lady, richly decorated with carved armorial bearings and needle-work, surrounded by a massy railing of carved wood; it was considerably raised from the floor, and a truckle bed for the younger children stood under its feet. In the opposite corners of this hall, two beds, each large enough to contain several persons, were screened off by curtains; in one of which slept the sons, in the other the daughters of the family. Round the sides of the room, the wainscoting of polished wood inclosed cupboards, where their clothes and other effects were kept; with the household linen, spun by the ladies and their maid-servants: a strong iron chest, let into the thickness of the wall, guarded the money, the jewels, and writings of importance. The light of the windows was obscured by the great thickness of the walls; within the recesses formed by them, the ladies assembled with their embroidery and other occupations. In the centre was a large table, which served for the family meals, when there were no guests present. Two arm-chairs of gilt leather, and some high stools, were generally the only portable seats. A few shelves contained the library of the castle, usually consisting of a legend

of the saints, some books of chivalry, and a translation of Plutarch's Lives. The winding staircase led from this to the third story, constituting the hall of the baron, warmed by a chimney large enough to roast an ox. . . . . The numerous high and narrow windows of the hall were enriched with painted glass, containing armorial bearings, or representing some event from history, the scriptures, or the lives of the saints. The corners were partitioned off, and contained beds for the accommodation of guests. In the story above this was lodged the warder of the castle, who, from his elevated post, surveyed the surrounding country, and gave notice, by his horn, of the approach of visitors or of enemies.

"The castle-yard was surrounded by a very strong wall, within which stood a chapel, store-houses, and the habitations of the male servants. The ground immediately adjoining, was planted with vegetables and fruit trees for the use of the castle; and beyond were the fields, cultivated for the baron by his immediate dependents."

VISIT TO ANTWERP AT THE CAPITULATION OF 1833.

Battles and sieges being rare occurrences in the present day, we propose to present to our readers some particulars relating to the siege of Antwerp, an event which occupied, during its progress, an engrossing share of public attention. Upon the present occasion, our relation will chiefly restrict itself to the local consequences of the bombardment.

On the morning of the 25th of February, shortly after the capitulation of the citadel, the writer of this account and a friend left Brussels by the Mechlin road, for Antwerp. Upon the western side of Mechlin, in addition to the regular fortifications of the town, a small ravelin had been thrown up to command the road, and several guns, mounted *en barbette*,* were placed in battery behind it.

The ravelin being exactly in advance of the town gate, the road, originally straight, had been turned a little to the right, and made to enter between the gate and the ravelin.

A league or two further on, the little river Neethe crosses the road, and advantage had been taken of this circumstance to throw up a rampart behind the stream, forming thereby a position of some strength, should the French army, under any unforeseen circumstances, have thought proper to retire. The road between this and Berchem is perfectly straight, and raised slightly above the surrounding country: no works had been erected upon it, owing probably to the level nature of the ground; but the numbers of straggling soldiers, ammunition carts, waggons laden with shells, and gal-

* Cannon are usually placed below the level of the rampart, in which a small opening, called an *embrasure*, is cut. A gun *en barbette* needs no embrasure, being placed above the rampart, upon a carriage admitting of its traversing in any direction.

loping couriers, increasing as we advanced, indicated some very extraordinary commotion in the neighbourhood.

Berchem, one of the small suburban villages of Antwerp, at this time contained the head-quarters of Maréschal Gérard, and was the grand depôt for piles, gabions, and fascines, and other requisites for opening and maintaining the trenches; the tool-chests and paraphernalia of the artillery were piled up in the church-yard; and near, within an open square, were the unpretending memorials of some who had fallen in the trenches. The little village was in grand confusion; troops mustering, orderlies galloping in all directions, the slightly wounded loitering about, and idlers off duty devouring their brown bread and scanty rations, with a gusto that would have done credit to better viands.

In advance of Berchem, on the right, out of shot, but within the barrier or octroi of Antwerp, was the park of artillery, each piece neatly arranged with its attendant limbers, and the picturesque rows of *blindages*, or tents of straw and earth, in which the artillerymen were lodged; a few spare mortars, of large calibre, were visible from the road, the whole arranged with that precision and regularity, which pervades and marks a well disciplined engineer department.

The trees and hedges here, as in many places along the road, had been cut down for military purposes.

We were now close upon Antwerp, and the houses on either side of the road bore very manifest tokens of their contiguity to the citadel. The high road, for about three hundred yards, had been exposed to Chassé's fire, and the houses, low slight buildings, were perforated at various heights by the balls. But few shells had fallen beyond, to the right of the road, although the huge pits made by these missiles were very numerous on the left. One of the two windmills, mentioned, I think, in Gérard's dispatches, had received a ball in its wooden pedestal; the other, although prominently exposed, had escaped unhurt.

Upon entering the fortifications beyond the outer ditch of the town, two mortar batteries, pointed towards Fort Montebello, were visible, with a guard-house upon the left, and three enormous shells, whose appearance at once told us that they were intended for the great mortar of Liege.

Passing over the inner ditch, by means of a broad wooden bridge, raked by two casemated guns, we arrived at the gate-house, an edifice of some grandeur, erected by the Spaniards, and having delivered up our passports, were permitted, without further hindrance, to enter the town, of which we shall now proceed to take a short survey.

Antwerp is a city of very considerable magnitude, which, although like most of the ancient emporia of commerce it has passed the zenith of its prosperity, still preserves abundant vestiges of its former splendour and magnificence. The houses, or rather palaces, of the rich are extensive, lofty, and in good taste; the windows frequent and capacious, the panes of

glass large, and the portals of width sufficient to admit a carriage. The handsome parts of the town are chiefly in the Grecian, the curious and venerable in the Gothic, style of architecture. The streets, although badly paved, and without *trottoirs*, are for the most part broad, and there are a few subterranean sewers, a rare luxury upon the continent.

The public buildings are numerous and splendid, and the cathedral, after that of Milan, perhaps the most noble Gothic temple in the world.

The town is built upon the Schelt, there very broad: towards the land it is defended by strong ramparts, ravelins, horn-works, and a double ditch: there are six gates.

The population is about sixty-two thousand, and the Burgher guard near twelve thousand strong.

The citadel, erected from the designs of Pacciotto, by the infamous duke of Alva, is situate at the north-western extremity of the town, and separated from it, agreeably to the rules of fortification, by a spacious esplanade. It is in form a regular pentagon, contains some acres within its precinct, and is strengthened by three demi-lunes, three lunettes, a horn-work, and a wet ditch; between the gate and the river are dock-yards; and beyond the river are the Tête de Flandres, and the smaller forts and redoubts, its dependencies. Our readers will pardon this necessary digression.

In such numbers had the curious from all quarters poured in, that all the hotels were full, and not even a birth in the 'worst inn's worst room' was to be obtained: however, after much patient perambulation, a lodging was discovered, and speedily put into requisition.

The actual firing had ceased on Sunday, the 21st of January, but the capitulation was not officially made known until Monday morning, the delay having been caused, as was said, by the expectation of a courier from the Hague. The flag of the citadel was lowered on Monday, and on Tuesday morning early the garrison marched out, piled arms upon the *glacis* of Fort Kehl, and returned to their quarters as prisoners, the French mounting guard upon the citadel. At this period Chassé received in his casemate the visits of Gérard, the royal dukes of France, and several officers.

We proceeded to view that part of the town which had suffered. The Rue de la Cuiller, the next street to the esplanade, had been ruined by the bombardment of 1830; the houses, for the most part mean, were shattered, the roofs destroyed in part, the floors knocked in, and here and there a fragment of iron was lying in the road. The children were playing at marbles with grape and canister shot.

Men with carts were collecting broken shells within the esplanade, upon which, however, we were prevented, by a line of sentinels, from proceeding.

The long line of barracks between the ruined street and the river, together with a fine church, lay in ruins. The injury inflicted upon the pre-

sent occasion had added scarcely any thing to the extreme desolation of the scene; for, it should be remembered that all present damage done to these buildings was accidental, and caused by such only of the French balls as fell beyond their mark. But few shot, probably not half a dozen, struck the more distant quarters of the town. The streets, however, especially those towards the citadel and the river, were carefully barricadoed; that is to say, a mound of earth was thrown up across them, defended by wooden *chevaux de frise* and a ditch, a narrow passage permitting the ingress and egress of foot-passengers. The cellar windows, opening, as in England, upon a level with the pavement, were almost all stopped up with baulks of wood and loose earth, to defend the cellars, the last refuge of the inhabitants, from the bombs which they had momentarily expected. Two or three severe tumbles soon made the unwary stranger awake to this precaution.

Between the town and the river, the public promenade had been turned into a rampart, which was amply supplied with artillery of all kinds; across the river was the *coupure*, or place where the dyke had been divided, and by which that extremity of *poldre*, or meadow, behind the Tête de Flandres, had been inundated.

On Wednesday, at noon, we saw the forts on this land strike their colours. Having, by the kindness of a friend, obtained a pass from Gérard's aid-du-camp, we left the town by the Mechlin gate, and having gained the outside of the fortifications, took the high road to Berchem; but, after a few hundred yards, arriving at the part which had suffered from Chassé's fire, we turned aside to view its effects upon a cherry orchard. The trees, planted at the usual distance, had suffered severely, and it was curious to trace the passage of a ball from tree to tree, falling gradually, until it buried itself in the soft black soil of some celery beds below; the trees were small, and many of the trunks, through which balls had passed, had absolutely closed up again so completely, that not even a small stick could be introduced. It appeared as though a knife had been passed through in all directions, each time splitting the tree.

The cottages near were decidedly the worse for the cannonade, and one or two once gay summer-houses were in a woeful plight; here was a fine *blumen-garten*, with a painted *lust-haus*, the burgomaster's delight, very much discomposed by its treatment. The cottages in this direction were not absolutely destroyed; so the poor people had returned to them, and were then surveying the damage, with a view to its repair.

Passing across the road towards the trenches, we perceived a vast number of large holes in the earth: these were made by the shells, and many of them would have held three or four loads of earth. When a shell falls, if the ground be soft, it buries itself deeply, and then exploding, blows about the soil in all directions. Where it falls blind, that is to say without

exploding, it remains buried, and requires digging out. The whole ground was full of these pits.

We walked on through what had once been a series of market gardens, towards the citadel, and soon met a number of artillery men escorting, with divers facetiæ, a huge clay figure of "our lady of the Capuchines," who had been on duty as protectress of battery No. 2, during the siege; "Il-y-a assez des Capuchines," quoth the fellow who carried her, and passed on with his band.

We now began to search for the trenches, and, moving about rather carelessly, actually tumbled into the third parallel, before we knew where we had alighted. A trench is a ditch about four feet deep, the excavated earth, making about three feet more, being thrown up on the side towards the enemy, and retained in its place by means of *gabions,* or hampers without tops or bottoms filled with earth; behind are two steps called *banquettes,* upon which musquetry is placed to annoy the enemy, and defend the trenches in case of a *sortie.* At proper distances the trench is widened, and a sort of platform laid down, upon which the guns are placed, rolling backwards and forwards in strong wooden grooves. The guns are protected by a rampart, in which, opposite to each, an opening or embrasure is cut; in the rear is a wooden cell, covered with earth, and bomb proof, for ammunition. Batteries are thrown up during the night, and perfected during the day.

We now observed '*le gros mortier de Liege*' of 22-inch calibre, and its shells of a thousand pounds weight. It was fired with a detonating lock and a long string. The people stood round at a respectful distance, staring at it open-mouthed.

We next entered Fort Montebello. The way over which the guns had been dragged was a sea of mud, which, notwithstanding the faggots thrown in, swallowed up three parts of each gun-carriage. I had the good fortune, on one occasion, to see three of the enormous 18-pounders from the breaching battery, dragged by the united efforts of about twenty horses along this apology for a road.

Montebello was not much injured; the brick cellar or casemate, then above ground, bore a few marks of shot, and one or two shells had left their usual *souvenir,* the round hole. Two mortar batteries had played from thence, and, to judge from the state of their tenants, had done good service. Behind Montebello was the dogana, or custom-house, perforated, and a pretty little garden upon the glacis of the ditch, the only thing that looked peaceful amidst this scene of war.

We left the fort by the opposite gate along the Boom road, and marching up an infinity of zig-zags, soon arrived at the breaching battery. This formidable battery, consisting of six 18-pounders, was placed opposite to, and not many yards from, an appalling defalcation of the citadel wall. This was the breach. The guns were about fifteen feet apart, defended in

front by a high and strong rampart, pierced with port-holes, and well lined with *fascines*, or long faggots; all this had been performed under a galling and point-blank fire from the cannon and musquetry of the citadel. Notwithstanding, every thing was as neatly and exactly laid out, as though the whole had been erected for a review on the Champ de Mars. As each gun was discharged and recoiled, a gabion filled with earth was stuffed into the port, to keep out the musquet bullets. The fascines near the muzzles of the guns were intensely, we might say terrifically black, from the repeated explosions. In front of the battery, the glacis, occupying the few yards on the margin of the ditch, was ploughed up by the projectiles; we do not think six inches square together had escaped. The ditch, though wide and deep, was almost choked up by the rubbish of the breach. On the right of the breaching battery was a covered way or tunnel, beneath the glacis, and opening upon the *revêtement* of the counterscarp.* By means of this tunnel, which communicated with the trenches, the grenadiers of the forlorn hope were to pass into the ditch, filling it up with sand-bags in their way, whensoever the breach should be declared practicable by the engineers. To prevent this, Chassé had prepared two tiers of batteries upon the right flank of bastion Fernando; and thus raking or enfilading the ditch, he rendered all passage impossible, so long as those batteries could be served. They were in their turn battered by a counter or dismounting battery, placed exactly in their front at right angles, and to the left of the breaching battery. This counter battery consisted of six 18-pounders, and had been beautifully played. One of Chassé's batteries had thus been totally annihilated, and the other could not much longer have stood the tremendous fire. In the rear of the breaching battery, to the right, were two heads or elevated banks, one above the other, behind which musquetry was placed, to direct a galling fire upon the artillery men and *tirailleurs* of the citadel.

Below, in the ditch, on the extreme right, lay the ruins of the *batardeau* or dam, a stout brick wall, separating the waters of the citadel from those of the town ditches, and which had been blown well nigh out of water, at an early period of the operations; the ditches were in consequence almost dry.

We next proceeded to Fort St. Laurent, the *lunette*. Here also a tunnel had been opened between the foremost trenches and the counterscarp (in this case without a revêtement), from which a miner was pushed, upon a plank, across the ditch; this man, applying himself to the opposite wall or scarp, soon made by the help of a petard a small opening, and then a gallery terminating in a chamber; in this latter a large quantity of powder was deposited with a lighted slow match, and the miner fairly made good

* The counterscarp is that bank of the fosse or ditch, which is furthest from the fortification; and the wall with which such banks are usually lined is called a revêtement.

his retreat before the enemy were at all aware of the matter. The powder soon exploded, and the greater part of the front or salient angle of the lunette was blown into the ditch. The breach thus made was instantly scaled, and the grenadiers meeting with two other companies which had charged round by the rear or *gorge*, joined them, and took the garrison prisoners. No lives were lost, and the only serviceable gun found was in ten minutes turned against the citadel.

We entered the lunette by the breach, rendered by that time a good road. Guns, hurled from the rampart by the shot, lay dismounted beneath their broken carriages; the guard-house and *gorge-wall* were in ruins, and the wooden palisadoes riddled by musquet balls. Either no casemate had existed in this fort, or it had been completely blown away, for not a vestige of one could be seen.

Leaving St. Laurent by the gorge-gate, or *port de secours*, we entered the *demi-lune*, or *ravelin* (a work of the same nature placed immediately behind it), in its rear, clambering over a shattered sluice. This part of the work had not, it is true, been mined and blown up, but the horrors of war were nevertheless far more apparent in it. The bridge communicating with the citadel was cut to shivers by the shot; guns, many in number, lay buried in black mud behind the rampart; a few remained above; one of them, a fine brass long six, had been spoilt by a ball, and the touch-hole of another had been melted by hard firing. On the *terre-plein*, or body of the place, were some suspicious looking hillocks, and an open pit or two; from one of the former a hand and arm were observed to project; they looked fair and white as a lady's, as they lay imbedded in the muddy soil.

We turned away from so sickening a sight, but it was only to behold another: an artillery man, the upper half of whose head had been carried away by a bullet, wrapped in his military capôte, lay extended beneath the rampart. Poor fellow! his comrades had buried him as best they could, and a shell had rendered their pious offices useless. The eloquent lines of the poet rose upon our memory at a sight oftener heard of than witnessed. An Englishman, standing by, detached a loose mass of the rampart with his foot, and a second time sepulchred the remains of "the warrior." The French soldiers looked up and applauded him.

There was a subterranean *casemate** in the demi-lune; the doors had been removed, and a mound of earth thrown up at a short distance from its portal, to diminish the danger of those within; a playing card lay upon the damp floor of the vault, and we could not but regret that those about to meet death face to face had not employed their short time more suitably.

* A casemate is a vault, usually of brick or stone, very long, but in other respects little beyond the dimensions of a London cellar. These are usually under ground. In the citadel they were of great extent, freely communicating with one another. They were damp, and usually without any furniture but a small stove and some straw mattresses.

This casemate was in the salient angle. The parapet, or wall of turf, which tops the rampart, was on the left side much damaged; sand-bags had been hastily used to repair it, and it was thickly strewed with flattened musquet balls, which latter certain Englishmen were busily collecting for the edification of their fair countrywomen at home.

Under the rampart of the right face passed a brick tunnel or sally-port, communicating by means of a draw-bridge with the opposite glacis. Behind the terre-plein, or flat space forming the body of the place, was the shattered *pont de secours*, the destruction of which had cut off the only direct communication between the garrison and their comrades. Near this, men were diligently employed in dragging the ditch for broken musquets and charged shells, taking care to unload the latter immediately, and stow away the powder in safety. We learned that they became entitled to a slight recompense, upon delivering each shell and pound of powder so obtained at the magazine. Their fishery had been very successful.

Quitting the demi-lune by the sally-port, we crossed the ditch upon the draw-bridge, which, however, the shot had effectually prevented from performing its office in future.

We now came to a series of trenches with a strong stockade; these had been prepared previous to the siege, to enable the garrison to throw troops, unhurt by the fire of the enemy, into St. Laurent: after its capture, the French advanced along them until they became exposed to the guns of the citadel: and then throwing up a strong rampart and parapet, they placed musquetry behind it, and effected a union with their own works on the left of the demi-lune. This rampart rested upon the salient of the glacis; a little in the rear, towards the gorge of the lunette, was a long pit, covered with planks and earth, a sort of a guard-house.

Coasting along the margin of the citadel ditch, we came to the exterior of the demi-lune behind the lunette Kehl, which differs only from that last described, in having no *pont des secours*, the needful reinforcements being supplied by a more circuitous route. The works in this quarter, having suffered comparatively little, afforded a good opportunity of studying more closely the nature of the communication between a demi-lune and its lunette.

The lunette is a couple of hundred yards or more in advance; its form is, to speak generally, that of an isosceles triangle, the apex towards the enemy; the two sides are protected by a ditch, the counterscarp of which is usually without a revêtement or lining wall; the base or gorge is defended by a wall pierced with loop-holes for musquetry, and called the *gorge-wall*, in the centre of which is a portal, with strong folding gates. The ditch terminates on either side abruptly, communicating with that of the citadel only by means of a covered drain. Behind the wall, the earth, for a few yards' space, is marked out into squares, like those of a chess-board; from each alternate space, a pyramid having been excavated, is placed upon the

remaining square, and stakes, sharpened at either end, are fixed in the centre of each hollow; the whole forming a trap, over which any troops must fall and give the alarm, should they attempt in that direction a nocturnal surprise upon the place. These are called *troups de loups.* Each lunette is placed exactly before its demi-lune.

From the gorge of the lunette, a road, somewhat excavated, and defended on either side by a rampart, ditch, and stockade, passes directly backwards until it reaches the glacis* and *covered way* of the demi-lune, at its prominent or salient point: it there takes the course of the covered way along the margin of the ditch, until its final termination in the bridge of the sally-port.

Fort Kehl lies very near to the river, which is bordered as usual by a dyke, upon which the Dutch out-posts were placed. Two or three small sentry-boxes appeared, covered with turf half way up, and turned towards the river, and a little in advance was a cottage, *melkhuys,* used, as it was said, as a guard house.

The Boom road runs at that point near the river, and was crossed by the first parallel; the soil is black and soft, and very moist; the parallel was full of water, and frozen. The trees here, though a full quarter of a mile from the citadel, had suffered severely; just out of shot was a suburban villa, sadly mauled by the soldiery. We supposed the doctors had been there, to judge by the *ambulances* in the court yard.

Walking along the trenches in the direction of Berchem, we came, through desolate gardens and levelled houses, to a curious, almost a ludicrous, spectacle: it was the *Jardin de l'harmonie.* This place, the Antwerp Vauxhall, consisted of a large plot of ground, containing sundry Chinese pagodas, Grecian temples, painted gods and goddesses in terra cotta, fish-ponds lined with painted tin, and geometrical flower beds; all no doubt very elegant in summer, and greatly delighted in by the portly burghers of Antwerp and their progeny. Such a place in winter always looks like a slovenly fine lady, sufficiently tawdry: but, in addition to this, it had been favoured with Chassé's particular regards, and a grand painted roof, supported upon long slender deal columns, was, it must be confessed, a superb mark; the ponds were filled up, a refreshment house riddled; a fine pagoda stood, like a lion passant, upon three legs, the fourth having been valorously extended in the air by a shell; the roof of the grand temple resembled a gigantic sieve.

The parallel ran close to the garden, and lines of black mud marked the route of the guns, as they had been perilously dragged up into battery. A stone fountain by the road side was broken, and the *siste viator* of some

* The glacis is that slope of turf, which falls from the outer side of the ditch towards the field; and the covered way is an excavated walk between the glacis and the very edge of the ditch, protected towards the field by what is styled the crest of the glacis.

unpretending being, who had taken up his long rest on the same spot, had shared in its fate.

The little village of St. Laurent, at hand, had suffered dreadfully. Those who live in a country like England value but little the blessings of peace, for they are happily ignorant of the miseries of war. The peasants were returning to seek the remains of their habitation, no easy task, where all alike had been involved in the terrible devastation. We do not in the slightest degree exaggerate, when we say that we took note of one house entirely razed, not one brick of the walls remained standing upon another; a shell had even shattered the vault of the cellar, and blown it up with all its contents from the foundation.

Be it related, for the honour of the priesthood, that the Curé of St. Laurent refused to desert his post, and actually remained on the spot during the whole siege, with such of his flock as were unable to move.

Leaving St. Laurent, we proceeded towards Berchem, to see the graves. We found them in the large open square, guarded by a sentinel; they were ranged in military order, four deep; and at the head of what might be called the column, was a plain black crucifix, and upon it, "Seigneur, donnez leur le repos eternel. Amen." The individual epitaphs were few, and much in the style of the following:

"Les officiers du 18me du ligne a leur camerade Massy Lieutenant des Voltigeurs, mort au champ d'honneur, le 16 xbre, 1832."

There was no display of pomp or parade, but all was remarkably simple and in excellent taste.

We now returned to the city, purposing on the morrow to visit the citadel.

Finding letters of introduction of but little use, owing to the confusion and bustle of the town, we determined to set forth without them, trusting by our wits to gain admission into the citadel.

The esplanade was guarded, but only by Belgians, so we coolly bribed the sentinel with a vingtaine of cents, and in common with all who could pay the same sum, found ourselves on the outside of the citadel gate. Here a little negociation was necessary; however, we pleaded and bribed so pathetically, that on the one hand the officer, and on the other the sentinel, found it impossible to resist, and a whole party accordingly entered the citadel itself for about twenty-four pence sterling.

The grand portal was wide open, the gates having been injured by the shot: on either side were smaller posterns, accessible by slighter drawbridges, opening from the main one. Such private entrances are common to all citadels, being intended to avoid the danger attendant upon opening the great gate.

Passing under a lofty archway, we came to a square, open above, and communicating by a second archway with the body of the place. This

space was full of beams and bricks, the ruins of two houses, which had formerly stood one over each gate-way. Mounting the rampart, to enter them, we fell in with a portion of an enormous sphere, which at once proclaimed itself to have proceeded from the great mortar of Liege; the lump of iron must have weighed nearly fifty pounds. A man near took up a smaller shell, to knock off a corner, and was about to throw it, when behold it was loaded; he put it down again rather abruptly. With a little clambering, we got into the gate-house. Chassé in peaceful times had, it seemed, resided there. The roof and upper story had disappeared, together with the ceiling of the lower rooms: a fine mirror was smashed to atoms, the window cases were blown out, and the walls and floor were rough and full of large holes; upon the wreck of the latter lay some five or six shot and shells, reposing very quietly after their rapid traject. Leaving the gate-house, we proceeded along the rampart towards the bastion Fernando, purposing to make the circuit of the work, before we descended into the interior. We groped our way into the first casemate we came to, it was beneath the bastion, a very long arched vault. In it were paillasses, villanously dirty; potatoes, copper forks, kettles, beef, and brown bread, all heaped together, and emitting an intolerable odour; at the further end were several shells loaded and primed; and near them an open powder barrel, with its leathern top. We pushed aside the apron, but it was empty, and then, to our horror, we observed that the whole of the floor was strewed with its contents, a spark would have blown us all up, and we had upon inspection nailed shoes. It may be concluded that we beat a speedy though cautious retreat.

The cannon on the ramparts were much injured; the mortars, being all sheltered, were in better condition; shot, shells, powder-casks, priming-horns, grape and canister, with abundance of matches, lay about in all directions.

The batteries on the right flank of bastion Fernando had suffered severely; the upper one, lately thrown up, had been destroyed by the fire of the enemy's counter-battery, and its materials had choked up the casemates below. As it is of immense importance to keep up a sharp and steady fire from the flank of a bastion; and, as the surface comprehended under that term is narrow, the guns are placed in tiers, like those of a ship of war, the lower batteries being in fact casemates with ports. This plan is faulty, inasmuch as it weakens the rampart; such had been the case here, the rampart and the upper batteries having been beaten away, leaving only the lower guns, two beautiful long brass twelves, in a serviceable condition. As each gun was dismounted, a new one had been dragged into its place.

Behind the bastion de Toledo, that in which the breach was effected, a double stockade had been thrown up, in case of an assault. The work here had been at the hottest; there was a large pit at the gorge, into

which gun carriages, musquets, haversacks, accoutrements, beef and potatoes, and the everlasting brown bread, lay in grand confusion. In fact, all the rubbish of the place, including no doubt a few dead men, had been tumbled in; and, to crown and stir up the whole, the enemy's shells had fallen thick in this direction.

In rear of the curtain which connects the bastion Toledo with No. 3, was the casemate said to have been occupied by Chassé, during the early part of the siege: Dutch and French journals, gazettes, returns of men, and other papers, lay scattered over the floor of the council-chamber; the gazettes were subsequent, many of them, to the commencement of the siege.

The port de secours, opening in the same curtain, was strongly barricadoed. The curtain itself had suffered. A gun upon bastion No. 5, was curiously injured; a projectile had struck it upon the right trunnion or central projection, and had broken the piece short across; it was large and of iron, and lay in two portions; the right wheel of the carriage was also injured. From local circumstances, it was improbable that any thing but a shell could have caused this curious accident, which the engineers seemed to consider as unprecedented.

Many a joke was cut upon the garrison library, consisting of some noble folios, chiefly music books, which had been thrown into one of the re-entering angles of the ditch, near to the common sewer.

In rear of bastion No. 5, was Chassé's casemate, containing three chambers, a wretched vault, even after the care that had been bestowed upon it.

Near this was the principal powder magazine, hourly expected to blow up, since structures equally strong had given way before the shells from the Liege mortar. This mortar, concerning the failure of which so much was said, fulfilled all reasonable expectations; its shells were intended to destroy not men but buildings, and they accordingly broke through every thing upon which they fell.

Upon the rampart was the tomb of some soldier of former times, who had fallen at his post, and been buried where he fell.

We now descended into the interior of the citadel, occupied centrally by a large *place*, surrounded by barracks, stables, officers' quarters, a powder magazine, and a church.

The centre had been used as a parade ground, and during the siege, as a depôt for spare shot and shells, which had been piled there with military regularity. The enemy's fire, however, had sadly disarranged all the neat pyramids, scattering their component parts in all directions, and leaving only portions of the lower rows, to show where they once had stood. Some of the balls were broken into two pieces.

Of this central space, not a square yard together had escaped, it was covered with broken iron and scattered earth; the pavement had been torn up partly by the shot, and partly used by the besieged to charge their mor-

tars with. The remains of a road passed diagonally across; on the right were piled the firelocks of the garrison, not in very serviceable condition; their bayonet sheaths and cartouch boxes formed a second heap; and a huge pile of bedding and stores, of which a commissary was taking an inventory, a third; the stench here, as throughout the whole place, was intolerable. Near the entrance were the ruins of a long row of houses, levelled to the lower story, and still smoking.

Passing through a strong iron grate, broken by the shot, we entered the stables. The stone mangers were shattered, balls lay about as usual, and two or three oxen, killed by splinters, lay extended upon the rugged floor; there was a hole in the head of one animal, through which a hand and arm might readily have been passed. Near to this was an *abattoir*, where other oxen lay slain, one without a head; and one of the public kitchens, a very strong wooden building, thickly covered with turf, and defended on the exposed side by a *cavalier*, or mound of earth. Strong as it was, a shell, probably one of the enormous ones, had descended through the roof and exploded; the great cauldron, full of pea soup and ox bones, was blown up, and its contents lay far and wide. The cook was probably blown up too, at any rate no signs of him appeared. The other kitchen had escaped. The pumps, of stone, were all broken, and the wells choked up; the garrison had suffered a good deal for want of water.

A disconsolate cat was prowling about the ruins, looking rather bewildered; she was quite delighted, and ran up on being spoken to. Some carrier pigeons remained perched upon what had once been their cote.

The hospital, a long temporary casemate, in part of brick and in part of wood and turf, gave way beneath the storm of projectiles, and wretched had been the condition of the wounded. Here were the dead, laid in heaps in this Golgotha, with lighted straw and quick lime; the ground was thickly covered with straw, the contents of the paillasses.

The church, a tolerably capacious edifice, suffered severely; the tower had been levelled by one well-directed shot, and falling upon the roof, had smashed it. Shells had completed the work. With some difficulty, clambering over broken rafters, we got in, and the first thing we observed was the great clock-face upon the pavement. The high altar was degraded, and the marble dais before it broken. An ostentatious monument to "Don Fernando di Solis Bargas, Cabballero," &c. was destroyed, and his fine marble effigy overthrown; near was the humble tablet of a widow, respected even by the shells.

In the garden of the church was one of those curious hedges, so much esteemed in the Netherlands: the trees, when young, are interwoven together into a sort of lattice work, and in time they grow together at the points of junction, forming a strong reticulated fence all in one piece.

The shops in Antwerp were shut up during the siege, and many of the inhabitants removed themselves and their goods to Mechlin. The French

wounded were admitted into a noble hospital in the town, and placed under the care of M. Seutin, one of the most humane and accomplished surgeons that the Continent can boast of. After the capitulation, the Dutch wounded were removed to the same place; these men had suffered much from the weakness of their hospital, and the rude knowledge of their surgeons.

On one occasion we went round the hospital with King Leopold and his suite. The monarch spoke a few words to each soldier, and to the most deserving gave crosses and pensions. This attention on his Majesty's part had a wonderfully beneficial effect upon many of the cases. The French soldiery are, taken as a body, we are confident, far superior in information and good breeding, to any similar class in any other country in the world.

And now, lest our readers should be wearied, we shall conclude. The picture which we have attempted faithfully to pourtray, is, we are well aware, imperfect; it must have been so, beneath even an abler pencil than ours. To those who have passed their lives on the smiling plains of England, whom the clang of the tocsin has never summoned as conscripts to the war, nor the roar of artillery frighted as fugitives from their homes, words can convey but an inadequate impression of the horrors of war.

P.S. It may be mentioned that the citadel conveniently held a garrison of 4470 men, with 144 pieces of ordnance, ammunition, and military stores. The army of Gérard consisted of 54,000 infantry, 6000 cavalry, 6450 engineers, artillery-men, and pontoniers; in all 66,450 men, 14,300 horses, and 144 pieces of battering train, and 78 of field artillery.

REMARKS ON THE HISTORY OF INVENTIONS.

The object of the series of papers of which the first is now submitted to the reader, was intended to be an attempt to trace the history of the most remarkable inventions on which the arts essential to human society depend; —a subject so miscellaneous seems well adapted to meet the views which generally lead men to turn over the pages of a miscellany: and it is interesting to pursue the progress of the reason given to man, as far more than a compensation for his destitution of natural instruments, like those possessed by other animals, in triumphantly vanquishing all the difficulties of his situation, and extending his empire over surrounding nature;—to note his first rude efforts, the infancy of his arts in the savage state, and follow them on to that full development which constitutes civilization.

Although we find the several particulars which would enter into such a survey, scattered in very many and sufficiently common volumes; I know not where we shall find any attempt to present such a continued view of them, as seems desirable in order to illustrate the subject in its general bearings and relations. We have indeed a very entertaining volume, entitled, "History of Inventions," by Professor Beckman (which has been

translated into English); but this is a perfectly desultory composition; and, instead of attempting to trace the first foundations of the most essential arts, presents only rambling notices of trivial and subordinate details connected with a very few of them.

I shall first premise a few observations on the method which it is my own intention to follow.

I. Considering the general dependence of all human arts on the employment of artificial tools, I shall first commence with a few observations on the steps by which man has advanced in the employment of the most essential and universal of these instruments; and the manner in which he avails himself even in the rudest state of the more obvious mechanical powers; reserving all observations on more complicated machines for the consideration of the specific arts to which they are applied.

II. The first application which man requires to make of the tools with which he has thus furnished himself, is to provide himself with shelter from the inclemencies of the weather: the construction of his habitations, therefore, is the first of his arts which we shall have to notice.

III. We may next consider his means of providing himself with food. It may seem, perhaps, that this article ought to have preceded the former, inasmuch as it may be said, man must find food before he seeks a dwelling; but this will apply only to the most obvious supplies afforded him at once by the free bounty of nature. The employment of art to procure and extend those supplies, appears clearly subsequent in the order of invention to the providing shelter for his head; unless indeed in those few and favored climates, where he can safely bear constant exposure. Under this head, with reference to animal food, we shall have to consider man in the successive stages of hunter and shepherd; and to notice his weapons for the chase, and his arts for the domestication of animals. With the supply of vegetable food we shall find many essential arts connected,—agriculture, the naturalization of foreign vegetables, the construction of mills to grind his corn, and of ovens to bake his bread; the supply of water also being essential to quench his thirst, and to irrigate his plantations, the most essential machines for procuring it should be here noticed.

IV. The warmth of clothing is in most countries no less essential than the shelter of a roof, or even food itself. Under this head the first rude coverings of skin, and the subsequent fabrics of the spinning wheel and weaving loom, will present themselves to our notice.

V. Next to these necessary arts of preservation, we find, alas, was the great art of destruction, rivalling every other in universal extent. Here we shall have to notice weapons of offence and defence, the construction of forts, &c.

VI. The manufacture of metals may next be considered; and the kindred subjects of the various productions of pottery and glass may here also find a convenient place.

VII. The arts directed to extend man's power of locomotion on his own element, by the employment of horses and chariots, and by the construction of roads and bridges; and on the water by the successive vessels employed in navigation, may well close our survey of the necessary arts of human life.

Another large field would remain, were we to undertake the consideration of the intellectual and ornamental arts and sciences,—alphabetic writing, music, painting, sculpture, the instruments employed in astronomy, and the like; but we guess (as the Americans would say) that our readers and ourselves will be well weary of our present task, without undertaking this additional investigation; and on these subjects almost every general treatise on the several arts and sciences will be found to contain a sufficient history of the progress of each.

In tracing under the above heads the gradual development of the most essential arts, we shall first view them as they exist in a rudimental state, under a savage condition of society, as exemplified among the Polynesian islanders, and the Esquimaux. Of the earliest periods of civilization, the Bible presents our only record: brief as the narratives there preserved are, we shall yet find many hints applicable to our inquiry scattered through those sacred pages, which are richly stored with the most various information, in order, as it were, to allure us to their more frequent perusal. With reference to the state of the arts in the heroical ages of classical antiquity, we find an inexhaustible treasury of information in the Homeric poems, which are no less interesting to the archæologist, from their minute details of all the usages of that distant day, than to the poet, from the sublimity of their composition. Such are the sources we shall principally consult as to the first steps in the progress of invention.

From the great extent of the subject, our survey will necessarily be very rapid; but still it is hoped sufficient to place distinctly before the mind of the reader the various materials which it would be the business of a more elaborate and voluminous treatise fully to work out in detail. A sufficient specimen of the manner in which it is proposed to execute this design, will be found in the following introductory article.

I. On the employment of artificial tools to direct and assist the powers of man; and his availing himself of other natural moving powers.

Man has been justly defined to be a being distinguished from other animals, by accomplishing almost every operation which he undertakes by the intervention of artificial instruments; while the other animal races, even those which do possess a kind of arts, as beavers in the fabrication of their dams and huts, birds in the construction of their nests, and various species of insects in that of their cells, use their materials in the same natural state in which they find them; and require no other instruments for their arrangement than the organs with which nature has furnished their mouths and extremities: but man seldom uses his materials in a rude state; they

require to be manufactured before they can conveniently be applied to his purposes. For the shaping a trunk of a tree into pieces of timber is a species of manufacture, and this is almost universal: now this is an object which man is quite unable to accomplish by any natural instruments he possesses. The human hand is indeed itself the most admirable of all animal organs, and is strictly co-ordinate with human reason, to which it gives effect; but still with the hand alone man can neither pluck up a tree by its roots, nor shape it should he find it accidentally fallen. The hand has been well described by Galen as the instrument effective of all other instruments; and it is in this that the great superiority of man consists. He is not limited to the single range of a limited supply of specific natural organs, but has the power of inventing with his mind, and fabricating with his hand, whatsoever instruments he may require; he is therefore, as the Greek tragedian speaks, *παντοπορος*, having a contrivance for every thing.

The most essential tools are those of cutting, the knife and the axe. The rudest savages, unacquainted with the use of metals, employ for this purpose sharp slices of hard stone, to which by attrition they impart the forms they need. The teeth of the shark and other bones are occasionally employed for like purposes; yet with rude and imperfect instruments like these, the Polynesian islander is enabled to fell trees, to shape canoes, and to adorn his weapons with very elaborate carving; in this process he is assisted by files constructed of rough stones. Masses of stone also supply to all savage nations obvious substitutes for hammers and wedges. The introduction of iron afforded the best conceivable material for these implements; and that most convenient implement for dividing timber, the toothed saw, seems speedily to have ensued. We find MGRE, which the Septuagint and all other translators have thus rendered, in the book of Chronicles I. xx. 3; and Hesiod mentions sawn timber;* but here there is nothing to distinguish from any other implement of cleavage. In So-

* The planks of shittim wood employed in the construction of the tabernacle (Exodus xxvi., xxxv.), are denominated by a term only expressive of their being compacted together, QRSIM, and may have been formed by hewing them smooth, as easily, though less œconomically, as by an instrument like the saw. Homer never mentions the saw, though he gives a particular description, in the fifth Odyssey, of the whole proceeding of Ulysses, in felling and fashioning the timber to construct the vessel in which he left the isle of Calypso, for which the divine nymph herself furnished all the requisite tools, which of course were of the best description known to the poet; these were a large double-bladed hatchet, *πελεκυς*, for felling the timber, a smaller axe for shaping and polishing, *σκεπαρνος*, instruments for boring, *τερετρα*, and a carpenter's square, *σταθην*. These were made of brass; for iron, though known in the time of Homer, appears from the greater difficulty of reducing it, to have been very sparingly employed, and only for smaller implements. We shall have occasion to return to this passage, when we come to speak of naval architecture.

phocles, however, we find a distinct description, which cannot be mistaken (Trachiniæ, 712) :

Ωσε πριονος
Εκβρωματ' αν βλεψειας εν τομη ξυλϖ.

"Thus from the saw
The dust flies scattered as it cleaves the wood."

The saws represented in the paintings of Herculaneum have exactly the same form as those of our carpenters, and are used in the same manner.

But what an interval is there between the first invention, and the construction of instruments like the circular saws moved by steam, in the block machinery of Portsmouth.

The classical writers have handed down several tales concerning the invention of the saw ; but the personages and circumstances mentioned are clearly rather mythological than historical. Some ascribe it to Dædalus, others to his nephew Talus, who is said to have been led to the discovery by using the jagged jaw-bone of a species of serpent, for dividing wood, and then to have imitated the form in iron : his jealous uncle, we are told, murdered the inventor and pirated the invention. Other authorities again (among whom is Ovid) call this unfortunate nephew of Dædalus by the name of Perdix, and say that he imitated not the jaw-bone of a serpent, but the spine of a fish.

Ille etiam medio spinas in pisce notatas
Traxit in exemplum ; ferroque incidit acuto
Perpetuas dentes, et serræ repperit usum.

Some commentators have supposed that the bone here called spina, must be the serrated bone projecting from the snout of the saw-fish, pristis, which we are told was really used as a saw, by the aboriginal inhabitants of Madeira. This is indeed very probable; but with regard to the Ovidian tale, where we find that it concludes by the resuscitation of its hero, under the form of a *partridge*, after his being drowned by his uncle, it will be sufficient perhaps to treat it as he was himself treated, and make *game* of it.

We find the turning lathe mentioned by Theognis, in the sixth century, before our æra : Pliny says the name of the inventor was Theodosius Samius, of whom nothing more seems to be known.

Not only is the employment of these essential tools obvious, even to the least cultivated of the species, but we may also say the same of the employment of the simpler mechanical powers, to increase the force we are able to apply to any weight which we wish to move. Without reflecting on the principle, the savage would be naturally led to use his pole, to aid him in moving forward the trunk of the tree he had just succeeded in felling; and thus, like the bourgeois gentilhomme in Molière, he would employ the lever without knowing any thing about the matter. The usage

of the wedge and of rollers would be equally obvious. In navigating his canoe the principle of the lever is again exemplified, in the action of his paddles; and the simplest tackle for raising his mast, or hoisting his sail, must present fresh instances of the same kind, as also of the principle of the pulley. It is quite unnecessary to quote from Homer the process of launching a vessel:

> Μοχλοισιν δ'αρα τηνγε κατειρυσεν εισ αλα διαν:
> "With levers then he launched it in the main."—Od. E. 261.

Aristotle, among his multifarious works, has left a short treatise on mechanics: he describes the lever employed, as a steel-yard, ζυγος, or as a pole, μοχλος, the wedge, σφην, the inclined plane, ρομβος, and pulleys, τρυχιλαιαι. He refers their efficacy generally to the same principle as the lever, which he explains as depending on the greater proximity of the shorter than the longer arm to the centre of motion, and the consequent small size of the circle described by the former, as compared with the latter. He also speaks of a combination of these powers, employed by architects to raise great weights.* A little later, Archimedes composed a treatise of far superior merit, on the same subject; in this he has scientifically discussed the state of equilibrium in all these instances, and exhibits the practical skill of a modern engineer.

I am persuaded we shall find much earlier traces of a systematic use of the mechanical powers, in consulting the Egyptian remains. The architects who could construct the stupendous masses of the pyramids, must have been far advanced in mechanical skill. It would be interesting to turn over, with this view, the recent splendid publications, English and continental, in which are engraved such a vast number of the paintings decorating the sepulchral chambers of this extraordinary people; who, by thus pourtraying all their ancient manners, have made the abodes of death perpetuate the arts and habits of life for three thousand years. The present writer has no opportunity of consulting these volumes himself, but he mentions the subject, in the hope that some other correspondent of this journal, more favourably situated, may be led to do so, and communicate the result in some future number.

Besides increasing his own powers by mechanical instruments, man also presses into his service the strength of other animals, and even the forces of the natural elements.

The domestication of animals, for various purposes, is recorded among the earliest occupations of our race: in such consisted the wealth of Abraham and of Lot; and, as we find camels (those ships of the desert) included in the list, we cannot doubt but that the transport of men and burthens

* It is amusing in this mechanical treatise of Aristotle, to find two chapters devoted to the discussion of the grave questions, why dentists extract teeth most easily with their forceps, and why men employ nut-crackers to crack nuts.

already formed a part of these purposes. Horsemen, chariots, and waggons, are mentioned familiarly in the history of the sojourn of Joseph: ploughs were worked by oxen in the time of Moses, and we know that the Grecians and Romans employed asses to turn the wheels of their mills; but all these applications of animal power will require to be spoken of more in detail, when we come to consider the several arts in which they are employed.

Man, in the plenitude of the authority conceded to him over terrestrial nature, has even received power to exact service from the elements themselves. Of these fire is of the first necessity to him, and we may safely assert that its use is universal. There is indeed an absurd story, that when the Marian islands were first discovered by Magellan, the inhabitants were absolutely ignorant of fire; and when they first beheld its action in consuming wood, fancied it to be an animal preying on the vegetable matter: when, on approaching, their hands got burnt, they supposed, it is said, that this animal bit their fingers. Malte Brun however justly discredits this tale; the inhabitants belong to the great Malayan oceanic family, which is almost civilised, if compared with the semi-negro aborigines of New Holland, by far the most ignorant savages with whom we are acquainted, and yet even these are well acquainted with the use of fire. The Marions are remarkable for skill in the construction of the prows, with which they navigate the Pacific. These vessels were considered by Sir Sydney Smith to afford models, which he wished to introduce into European use; and as their islands abound in active volcanoes, it is quite impossible that they should have remained in the ignorance of an element constantly before their eyes, which this silly fiction ascribes to them. I think, however, that we must conceive the uses of fire to have been taught to the first parents of our race, by direct inspiration; for had man been left to learn for himself the uses of an element, which naturally presents itself to him only in the fearful ravages of volcanoes, or in the conflagration of whole forests struck by the terrible lightnings, he would surely have shrunk from it as a destructive tyrant, and been far from entertaining any idea of employing it as a friendly servant.

Fire is not only essential for warmth, light, and the preparation of food, but must greatly assist the rude tools of the savage, in excavating the trees designed for his canoes. When De Foe introduces Friday as recommending this process to his hero, he as usual adheres closely to nature and truth.

As the arts advance, it is fire which bestows on man the use of the metals, and is his great agent in chemical operations.

The employment of air as a moving power for vessels, must, from the earliest period, have suggested itself to every maritime people. The savage who had once launched his canoe would soon learn to spread his sail, and spare himself the fatigue of the oar: but the application of the same moving power to machinery in wind-mills, does not appear to have originated till as late as the twelfth century.

Water had been similarly applied at least as early as the days of Lucretius, who has left the following verse :—

"Ut fluvios versare rotas atque haustra videmus."

Modern science has, in Bramah's ingenious application of the principle of the hydraulic paradox to the construction of a press of truly gigantic powers, exhibited the most striking instance of the employment of water as a mechanical power.

The tremendous energies of steam as a moving power may be also regarded as a pure creation of science.

Nor is it at all improbable that the ulterior progress of science may present us with other new powers of equal or even superior efficacy. The vast expansive forces of the condensed gases has thus been suggested by Babbage ; but we may perhaps smile, when we find him expatiating on the superior facilities which Iceland, "where Hecla flames amidst eternal snows," possesses for the manufacture of such products ; and speculating on the probability of this ultima Thule hereafter becoming a great commercial nation, its principal article of export being POWER.

If I might venture to indulge in the same sort of bold conjectures, I would suggest the probability that hereafter we may be able to employ the repulsive force of electricity as a power of still more formidable energy. Should any discoveries enable us to develope this principle on a larger scale, and by more œconomical methods, than the machines now used, we may literally command the force of lightning.

TRANSLATION FROM THE ARABIC.

[IT is very generally supposed, that eastern literature has never attained that stage of maturity, in which men write *real prose;* in which good sense predominates over ornament, and mere imagination is sobered by taste. It is by the flowery rhodomontade of Persian authors, or the ridiculous pomp of Chinese diplomacy, that we are generally possessed with this opinion. But the Arab historians and geographers, as well as their writers on science, are of quite an opposite class ; writing in a style, not only simple, but sometimes so naked, unadorned, and primitive, that we can compare it only with that of the historical books of the Jewish and Christian scriptures. It is not, however, solely as a specimen of Arabic style, that we append from Jemal Ed Dìn the reign of an Egyptian Khalif. The facts narrated will, we doubt not, be amusing to some, incredible to others : while to those who see no ground to disbelieve the naked outline of the story, there will be instruction in the simplicity of the author's mind. Of the merit of stigmatising *us* as Christians with badges of dishonour, he evidently entertained no doubt : the submission of a subject people to the capricious rule of a madman, who seemed bent on starving them, must have

seemed to the writer only a natural exercise of patience. How light would our burdens have seemed in his eyes, how measureless our civil liberty !]

The Khalifate of El Hhàkem, by command of God; father of Ali Mansùr.

He was in the opening of his days good and wise. He ordered the Christians to dress in blue, and the Jews in yellow; and forbad them to ride on horses and mules. And he appointed for them separate baths, and made crucifixes thereon. And upon every church, he set a chapel at its top, with a Mohammedan* crier in it. But as he grew older, he changed from all this, and became devoted to the stars, and commanded things which made men laugh at him. Of this kind is it, that he passed one day by the Baths of Gold, and heard therein the clamour of women; whereupon he gave command to block them in, so they blocked them in until they all died. He also ordered to pull down the Church of the Resurrection, and to plunder every thing in it: so it was pulled down and plundered. Afterwards he ordered to restore it as it had been. He farther forbad any one to sell raisins; and next, forbad eating them: at last, he ordered to burn them in all the counties of Egypt and of Syria. Next, he gave orders to burn the grapes; and after that, to cut down all the vines. So all the vines were cut down in Egypt and in Syria, until there remained not a vine in Syria and in Egypt. After this, he commanded to kill the dogs; and there were killed in the towns of Egypt thirty thousand dogs. Then he commanded to empty out the honey; and men poured away twelve thousand jars. Then he forbad men to cook the mallows, and next, to sow the ground at all: and he hung all, in whose houses seed was found. Next, he forbad the sale of beans and lupins, and of the smooth fish; as likewise of meat and beer; and gave orders to hang whoever did it. And he hung a great many for this offence.

He would dress in woollen, and ride upon an ass, and patrol in the streets alone, without guards: and one night, as he went out on his patrolling, he was killed; and it was not known who killed him. Only they found his things with him, and his ass.

And in his days there appeared in Damietta an enormous fish. Its length was two hundred and sixty cubits, and its breadth a hundred ribs. And salt-asses went into the cavity of its belly, laden with salt, and came out laden with fat. And five men with iron hoes lived in his skull, to pick at his cheeks; and handed it out to the rest of the multitude. And the people of Damietta continued to feed upon him for many months.

El Hhàkem was young, when he succeeded to the Khalifate, and he committed the administration of his kingdom to a servant of his father's

* Such appears to be the sense; but in our text is a word which we do not understand.

called Arjùn ; until Hhàkem was grown up. But when he was grown up, he imprisoned the aforesaid Arjùn, and put him to death. He found among his property what cannot be explained for multitude : a thousand shirts, a thousand pair of trowsers, and a thousand trowser bands of silk. In all the trowser bands was the scent of musk and the scent of amber in abundance : and of jewels and vases he found to the amount of five hundred thousand dinars.

And when El Hhàkem had died in the month Shawàl, in the year 411, [A. D. 1033,] his son reigned after him.

POETRY.

SPECIMEN OF A NEW TRANSLATION OF THE LATIN POEM OF ISAAC HAWKINS BROWNE,

ON THE IMMORTALITY OF THE SOUL.

Of all the didactic poems which have ever been written in any language, we can hardly fail to assign the palm of superiority to the original, of which an attempt to transfer the introduction to the poetry of our own language is here presented : the supreme importance of the subject, the cogency of the arguments selected, their skilful disposition, the clearness with which they are stated (so opposed to the obscurity of other metaphysical poets), the poetical beauty of the illustrations, and vigour and elegance of the expression, are alike remarkable. In point of style, it is perhaps the most favourable specimen of modern Latin composition which has ever been produced in this island ; and the imitator need hardly shrink from a comparison with his great classical models. He has been absurdly enough compared to Lucretius, for he has evidently formed his poetry much more after the more refined type of the Augustan æra. Some former attempts at English translation have been given to the public ; but that of Soame Jenyns is said to be the best. If so, bad indeed is that best ; and it can argue very little presumption in any one to offer a new essay.

The original was published in 1759, by Mr. Browne, a barrister, who had received his education at Westminster school, and Trinity College, Cambridge.

I subjoin the introductory passage of the original, together with my own essay to "do it out of Latin," as the phrase is ; certain at least, that by the insertion of the former, I shall afford a great treat to the classical reader of our pages. Those who know how much the members of a public school pride themselves in its successful flirtations with the Latin muse, will find a sufficient apology for my endeavouring to recall attention to this boast of the disciples of Elia, when I subscribe myself

AN OLD WESTMINSTER

DE ANIMI IMMORTALITATE.

Cætera per terras animalia sorte fruuntur
Quam sua cuique dedit Natura; nec amplius optant.
Solus homo, qui scire sagax, cui summa cupido
Scrutari causas et mutua fœdera rerum,
Vanum iter ingreditur; nigris namque imminet alis,
Et cursu in medio Mors intercludit euntem.
Quorsum isthoc, si nil sapientia dia creârit
Incassum? Quorsum hæc divinæ semina mentis,
In proprios si non poterunt adolescere fructus?
Ecquid enim prodest rerum cognoscere causas;
Jungere venturis præsentia; mente vagari
Solem atque astra super, morituro? Scilicet omnes
Una manet Lethi lex et commune sepulcrum.
Nonne ergo satius cum Phyllide ludere in umbra;
Teque, Lyæe pater, lætis celebrare choreis?
Novit enim Bacchus curas depellere, novit
Præteriti sensus abolere metumque futuri.
Quare age, vina liques: epulæ, convivia, lusus,
Psallere docta Chloe, citharæque perita Neæra,
Non absint; volucris rape lætus dona diei;
Quærere nec cures quid crastina proferat hora.
Atqui pertæsum est harum citò deliciarum;
Scilicet, hæc satiat vix dum libata voluptas.
Ergo dimissis quæramus seria nugis.
Accumulentur opes; ducit quò gloria, quòve
Ambitio, stipatus eas examine denso
Manè salutantum. Quid multa? Huc denique eòdem
Volveris, ut clames heu! quantum in rebus inane!
Quænam igitur tentanda via est? Ubi littus amicum?
Nempe vides ut semper avet, dum corpore clausa est,
Mens alia ex aliis scire, ac sine fine gradatim
Æternum (sic fert natura) attingere verum.
Gaudia quinetiam non hæc fugientia poscit,
At magis apta sibi, vicibusque obnoxia nullis;
Gaudia perpetuum non interitura per ævum.
Quare sume animum; neque enim sapientia dia
Frustra operam impendit; neque mens arctabitur istis
Limitibus quibus hoc periturum corpus; at exsors
Terrenæ labis viget, æternùmque vigebit:
Atque ubi corporeis emissa, ut carcere, vinclis,
Libera cognatum repetet, vetus incola, cœlum,
Nectareos latices veri de fonte perenni
Hauriet, ætheriumque perennis carpet amomum.

TRANSLATION.

Through the wide earth, the tribes that roam the plain,
Cleave the blue sky, or cut the glassy main,
Each in the narrow sphere by heaven assigned,
The fulness of complete enjoyment find,
Nor know a wish beyond that lot confin'd.
Man—only man—whom reason's power inspires,
Whom still th' unsated thirst of knowledge fires,
To search for causes in their secret springs,
And trace the links that bind the chain of things,
Urged vainly by desires above his state,
Attempts a path forbidden him by fate,
For Death on wings of gloom still hovering near
Arrests his progress ere its mid career.
Say, why is this? if nought th' Almighty mind
Of all that it has made in vain design'd;
Say, why to man—to short-liv'd man—were given
These seeds of intellect, the growth of heaven,
Which scarce his transient spring permits to shoot,
Ere Death's cold winter blasts their hope of fruit?
What him avails it, though he thus connect
Things far remote, all nature's springs detect,
Expatiate by the mind's unfetter'd force
Beyond the solar orb and starry course?
These thoughts that wander through eternity,
Say, what avail they one so soon to die?
Were it not wiser far, at ease reclin'd
Amidst luxurious shades with Phillis kind
To toy away the noon, or at thy shrine
To seek for rapture, mighty god of wine?
For thy charm'd cup can chase with happiest skill
The sense of sorrow past, the fear of coming ill.
Bid then the goblet flow;—the thrilling lyre
Let Beauty's touch with strains of love inspire;
Snatch Joy's brief flow'rs, each moment as they spring,
Nor waste one care on what the next may bring.
But oh how soon these idle pleasures tire,
How pall the appetite of cloy'd desire,
Ere yet we scantily taste them. Leave we then
These toys, and seek for objects worthier men;
Heap wealth on wealth, or led by higher aim,
Pursue the radiant paths that tend to fame;
Till crowds admiring on our greatness wait,
And thousands swell the triumph of our state:
Alas, 'tis empty show, nor once deceives
The soul ungratified, that inly grieves

For better things, and while of these possest,
Feels yet an aching void within the breast.
What then remains to try? or how explore
The track that guides us to the wish'd-for shore?
See ye not then how still th' unwearied mind
Vainly by gross corporeal chains confin'd,
Pants, amidst all she knows, for knowledge new,
And holds her onward course, to nature true;
Till step by step she win the arduous height,
And truth's eternal form shall bless her longing sight.
From all the fleeting joys of sense she turns,
For joys more worthy of herself she burns,
Joys that shall like her own celestial frame
Last through all time unfadingly the same.
Look boldly forward then. There is an end
To which these earnest aspirations tend.
Nought is in vain in all th' Almighty's plan,
Nor has he vainly given these powers to man.
Think not the narrow span by fate assign'd
To waste the body can consume the mind.
She when this earthly dross is purg'd away,
Shall flourish without spot, without decay,
From bondage freed, shall wing her glorious flight
Back to her native realms of heaven and light,
Feed her fine essence with ambrosial dew,
And from Truth's sacred springs quaff streams for ever new.

A BIRTH-DAY HYMN FOR A CHILD.

Almighty Father, King of kings!
Accept the thanks an infant brings;
In early numbers I would praise
The great Supporter of my days.

Teach me to trust that Guardian power,
Which leads me on from hour to hour,
And has with kind and tender care
Preserv'd my life another year.

Young as I am, may I be taught
To give to Him each word and thought;
And if I live, O! may he still
Incline my heart to do his will.

But if the year which now is past,
By his command should prove my last,
Grant, gracious God! that I may see
Thy face to all eternity.

J. C.

CHARADE.

Addressed to Georgiana, Countess Spencer.

My first and second are the lot
  Of each delighted guest,
When ev'ry sorrow is forgot
  At Spencer's social feast.

My whole together forms a word,
  Which, when those hours are past,
We grieve to find, howe'er deferr'd,
  We must pronounce at last.

Fare-well.

J. C., *Northampton*, A. D. 17—.

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1 CORINTHIANS xiii. 13.

Faith, Hope, and Love were questioned what they thought
Of future glory which religion taught:
Now Faith *believ'd* it firmly to be true,
And Hope *expected* so to find it too,
Love answer'd, smiling with a conscious glow,
"Believe! expect! I *know* it to be so."

Hannah More.

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